REFERENCE 15

BUREAU OF LAND

SAMPLING PROCEDURES MANUAL

Illinois Environmental

Protection Agency

SEPTEMBER 1996

BUREAU OF LAND

SAMPLING PROCEDURES GUIDANCE MANUAL

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SECTION I. INTRODUCTION

A. PURPOSE

In the past the Agency has been challenged in court cases on the validity of data on the grounds that sampling and preservation procedures varied from person to person. In an effort to ensure samples are collected in a consistent manner to produce data that reflects actual site conditions, the Bureau of Land (BOL) formed a technical work group to develop a basic sampling procedures guidance manual. This manual contains sections which provide commonly accepted methods for collecting samples of the various media encountered at a site during an inspection. The following fourteen (14) sections of this manual will assist BOL personnel in collecting samples. The manual is not intended to contain all possible or innovative sampling methods, nor direct the sampler in determining the number and location of samples.

The Sampling Technical Work Group has included as much information as possible in a concise easy to use format, designed to be used in planning while in the office and executing a successful sampling event in the field. Most sections contain reminder checklists, an essential equipment checklist, and step-by-step sample collection procedures. The reminder checklists in particular are designed to assist BOL personnel in planning, executing, and completing a successful sampling event.

B. DISCLAIMER

The procedures presented in this manual are not final agency action, but are intended solely as guidance. These procedures are intended for use by IEPA-BOL personnel and should not be distributed to individuals, Agency contractors, and/or engineering/consultant firms outside the agency. IEPA-BOL personnel may decide to follow the guidance provided in this manual, or act at variance with the guidance, based on an analysis of specific site circumstances. IEPA also reserves the right to revise this guidance any time to include improvements in existing procedures or any new sampling methods available to the agency.

SECTION II: TANK SAMPLING

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SECTION II: TANKS

A. REMINDER CHECKLIST

1. Pre-Sampling Activities

___ Assess site hazards and develop and/or review a safety plan.

___ Establish purpose(s) of sampling.

___ Develop and/or review a sampling plan.

___ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment and ensure that it is in working order.

___ Bring enough clean water for rinsing, cleaning and cooling off.

___ Schedule lab time and order your bottles 2 weeks in advance.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the trip to ensure all sampling team members understand their roles and responsibilities.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.

___ Identify local suppliers of sampling expendables (e.g. ice, plastic bags) and overnight delivery services (e.g. Federal Express), and recharge of SCBA air tanks (local Fire Dept.).

___ Prepare site map indicating the location of tanks to be sampled.

___ Determine if site owner or operator will be splitting samples.

___ Prior to opening a tank for internal inspection, the tank sampling team should:

- ___ Ensure the tank is properly grounded.
- ___ Remove all sources of ignition from the immediate area.

___ If possible, request that the owner/operator open the tank for you.

___ Each tank should be mounted using appropriate means. Remove man-way covers using non-sparking tools.

___ The tank headspace should be cleared of any toxic or explosive vapor concentration using a high volume blower.

___ Prepare your sample containers prior to sampling (label and organize).

2. During Sampling Activities

___ Document the sampling event. At a minimum, include: weather conditions, date, time, sampler's name, photographs, sample appearance (e.g. color), any deviations from the original sampling plan, and any problems encountered.

___ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.

___ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.

___ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.

___ Never composite VOC samples.

___ Wipe off outside of sample bottles prior to placement in cooler.

___ Using a weighted tape measure, probe line, sludge judge, or equivalent to determine depth of any and all liquid-solid interface, and depth of sludge.

___ For liquids < 5 feet deep use a glass thief or COLIWASA to collect a sample.

___ Using a subsurface grab sampler or bacon bomb, collect liquid samples from one (1) foot below the surface, from mid-depth of liquid, and from one (1) foot above the bottom sludge layer.

___ Use bacon bomb to determine if the material is stratified.

___ In sampling a tank that is less than full and beyond the reach of standard equipment design, the sampler may need to improvise. A site visit prior to the sampling event is suggested to make a determination of the equipment and/or modification(s) required.

___ If sampling storage tanks, vacuum trucks, or process vessels, collect at least one sample from each compartment in the tank.

___ Samples should always be collected through an open hatch at the top of the tank.

___ Due to questionable or unknown integrity: **DO NOT USE VALVES NEAR THE BOTTOM OF THE TANK.** It may be that, once opened, the valves may not close and result in a release. Also, individual strata cannot be sampled separately through a valve near the bottom.

___ Compare the three samples for visual phase differences. If phase differences appear, systematic additional sampling should be performed. To determine the depth phase change the distance between two (2) discrete samples should be halved.

___ If another sampling port is available, sample as above to verify the phase information.

___ Measure the outside diameter of the tank and determine the volume of wastes using the depth measurements (Figure 2a & b).

___ Collect sludge samples by using a bacon bomb, glass thief, or sludge judge.

3. Post-Sampling Activities

___ Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE).

___ Keep samples cool; ship or drop off to appropriate laboratory in accordance with BOL SOP for Sample Packaging and Shipping.

___ Separate incompatible wastes samples so that they are not transported in the cooler.

___ Seal odorous wastes in a cooler to avoid breathing vapors or odors during transportation.

B. EQUIPMENT CHECKLIST

The selection of the sampling devices should be based upon waste properties (e.g., liquid or solid), site factors (e.g., waste accessibility, waste generation practices, and degree of hazard), and the analytes to be quantitated (e.g., VOCs or heavy metals). Ease of use under the site conditions and the degree of hazard associated with using a given device should also be considered. See the next page for a sampling equipment checklist for a list of the equipment used for sampling.

SAMPLING EQUIPMENT CHECKLIST:
TANKS

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book
_____Site Safety Plan

PROJECT MANAGER:

_____Field Logbook
_____Agency Phone Book
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera
_____Camera Batteries
_____Extra Film
_____Pencils & Pens (Waterproof)
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves_____L_____XL
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water

GENERAL SAMPLING EQUIPMENT:

_____Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
1/2-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____TVA
_____pH/Temp/Millivolt Meter
    _____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Safety Glasses
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape
_____Tie Wraps
_____Vermiculite

TANK SAMPLING EQUIPMENT

_____Glass Thief
_____COLIWASA
_____Bacon Bomb
_____Sludge Judge
_____Subsurface Grab Sampler
_____Bailer (inert volatile bailer)
_____Non-sparking Tools
_____Chem Wipes
_____Bailer Cord

C. PROCEDURES

NOTE: In many instances a tank containing waste material will have a sludge layer on the bottom. Slow insertion of the sample tube down into this layer and with gradual withdrawal will allow the sludge to act as a bottom plug to maintain the fluid in the tube. The plug can be gently removed and placed into the sample container by use of a stainless steel lab spoon.

1. **Glass Thief:** due to the size of the equipment, is limited to use in small tanks only. NOTE: Be careful, this tool is fragile and can be easily broken (Figure 2c).

a. Open the sample container(s) provided by the laboratory.

b. Insert glass thief almost to the bottom of the tank or until a solid layer is encountered. Note: About one (1) foot of the tubing should extend above the tank.

c. Allow the waste in the tank to reach its natural level in the tube.

d. Cap the top of the glass thief with a tapered stopper or thumb of a gloved hand, ensuring liquid does not come into contact with the stopper.

e. Carefully remove the capped glass thief from the tank with one hand while wiping the sampler with a disposable cloth, rag, or wipe with the other hand and insert the uncapped end in the sample container.

f. Release the stopper draining the glass thief and filling the sample container per laboratory requirements.

g. Return unused portion of retrieved sample to the tank and dispose of sampler properly.

h. Cap the pre-labeled sample container(s) tightly and place in the cooler.

i. Close the tank cover.

2. **COLIWASA (Complete Liquid Waste Sampler):** is a piece of equipment designed to collect a sample from the full depth of a tank and maintain it in the transfer tube until delivery to the sample bottle (Figure 2d).

a. Open the sample container(s) provided by the laboratory.

b. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.

c. Slowly lower the sampler into the liquid waste at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. Note: If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and the sample will not be representative.

d. When the sampler stopper hits the bottom of the waste tank, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.

e. Slowly withdraw the sample from the waste tank with one hand while wiping the sampler tube with a disposable cloth or rag with the other hand.

f. Carefully fill the sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.

g. Return unused portion of sample to the tank and dispose of sampler properly.

h. Cap the pre-labeled sample container(s) tightly and place in the cooler.

i. Close the tank cover.

3. Bacon Bomb Sampler: is designed to collect material from various levels in a tank (Figure 2e).

a. Open the sample container(s) provided by the laboratory.

b. Attach the sample line and plunger line to the sampler.

c. Measure and then mark the sampling line at a predetermined distance below the entry port using either a colored laboratory marker or tape or equivalent device. Do not allow the marked area to enter the tank.

d. Gradually lower the sampler by the sample line until the desired level is reached.

e. Pull up on the plunger line to fill the sampler and release the plunger line to seal the sampler.

f. Slowly remove the sampler by pulling up on the sample line and wipe the exterior of the sampler with a disposable wipe, clean cloth or wipe then transfer the contents to a sample container.

g. Return unused portion of sample to the tank and dispose of sampler properly.

h. Cap the pre-labeled sample container(s) tightly and place in a cooler.

i. Close the tank cover.

4. Sludge Judge: is used for obtaining an accurate reading of settled solids, in any liquid, to any depth. The sampler consists of 3/4-inch plastic pipe in five (5) foot sections, marked at one (1) foot increments, with screw-style fittings (Figure 2f).

a. Open the sample container(s) provided by the laboratory.

b. Lower the sludge judge to the bottom of the tank.

c. After the sampler has reached bottom and the pipe has filled to surface level, tug slightly on the rope to seat the check valve trapping the material and raise the sampler.

d. After raising the sampler clear of the tank liquid, read the amount of sludge in the sample using the one (1) foot increments marked on the pipe sections.

e. Before transfer to a sample container, wipe the exterior of the sampler with a disposable chem wipe or other laboratory grade wipe, disposing of the wipe properly.

f. Touch the pin extending from the bottom section against a hard surface to release the material from the sampler and empty the material into the sample container.

g. Return unused portion of sample to the tank and dispose of the sampler properly.

h. Cap the pre-labeled sample container(s) tightly and place in a cooler.

i. Close the tank cover.

5. **Subsurface Grab Sampler:** is designed to collect samples of liquids at various depths. The sampler is usually constructed of aluminum or stainless steel tubing with a polypropylene or Teflon head that attaches to a one (1) liter sample container (Figure 2g).

   a. Open the sample container(s) provided by the laboratory.

   b. Screw the sample bottle onto the sampling head.

   c. Measure and then mark the sampling line at a predetermined distance below the entry port using either a colored laboratory marker or tape or equivalent device. Do not allow the marked area to enter the tank.

   d. Pull the ring at the top which opens the spring-loaded plunger in the head assembly.

   e. When the bottle is full, release the ring, lift the sampler, and remove sample bottle. Wipe the exterior of the sampler and sampler bottle with a disposable wipe, clean rag or cloth and dispose of wipe or rag properly.

   f. Pour the contents into the sample container(s).

   g. Cap the pre-labeled sample container(s) tightly and place in a cooler.

   h. Close the tank cover.

6. **Bailer:** is the positive-displacement chemically inert volatile sampling bailer. Other bailer types (messenger, bottom, fill, etc.) are less desirable, but may be mandated by cost and site conditions (Figure 2h).

   a. Open the sample container(s) provided by the laboratory.

   b. Due to the potential of dripping and spillage, lay out clean plastic sheeting around tank, specifically in the vicinity of the sampling port.

   c. Lower the bailer slowly and gently into the tank so as not to splash the bailer into the tank contents.

   d. Allow the bailer to fill completely and remove from the tank with one hand while wiping the exterior of the sampler with a disposable wipe.

   e. Slowly pour the contents of the bailer into the sample container(s).

   f. Return the unused portion of the sample to the tank and dispose of sampler properly.

g. Cap the pre-labeled sample container(s) tightly and place in a cooler.

h. Close tank cover.

D. REFERENCES

Reproduced in part from OSWER Directive 9360.4-03, January 1991.

E. FIGURES

2a -- Various Volume Calculations

2b -- Various Volume Calculations (contd.)

2c -- Glass Thief

2d -- COLIWASA (Complete Liquid Waste Sampler)

2e -- Bacon Bomb

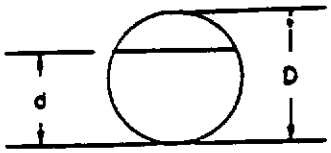
2f -- Sludge Judge

2g -- Subsurface Grab Sampler

2h -- Bailer

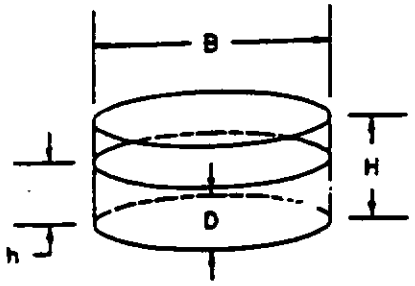
FIGURE 2a – VARIOUS VOLUME CALCULATIONS

SPHERE



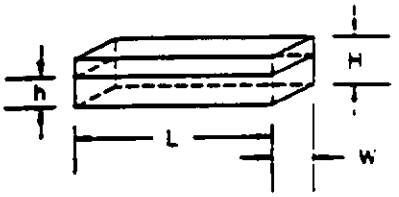
Total Volume
$V=1/6\ \pi D^3 = 0.523498 D^3$
Partial Volume
$V=1/3\ \pi d^2\ (3/2\ D-d)$

ELLIPTICAL CONTAINER



Total Volume
$V=\pi BDH$
Partial Volume
$V=\pi BDh$

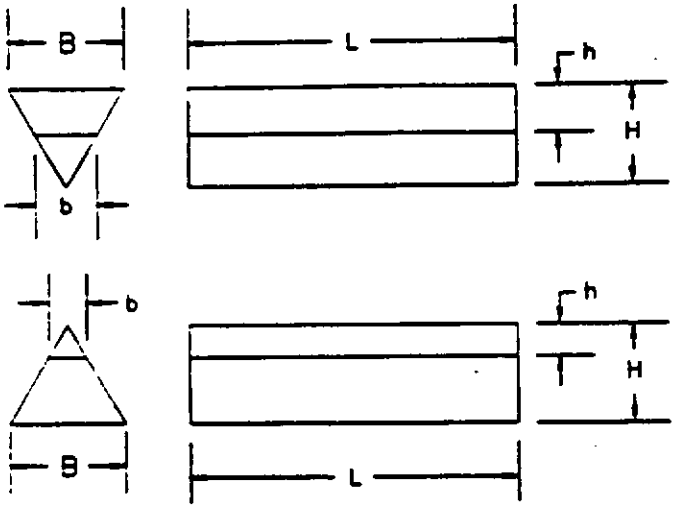
ANY RECTANGULAR CONTAINER



Total Volume
V=HLW
Partial Volume
V=hLW

TRIANGULAR CONTAINER

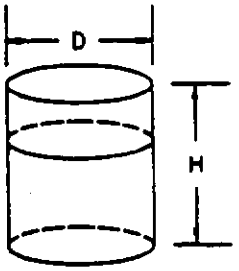
Total Volume
V=1/2 HBL



Case 1
Partial Volume
V=1/2 hbL

Case 2
Partial Volume
V=1/2 L(HB−hB)

RIGHT CYLINDER

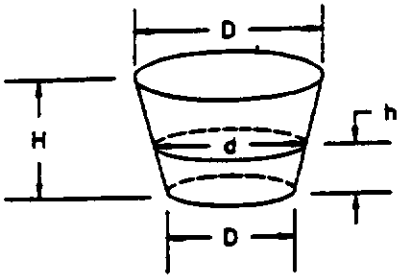


Total Volume
$V=1/4\ \pi D^2\ H$
Partial Volume
$V=1/4\ \pi D^2\ h$

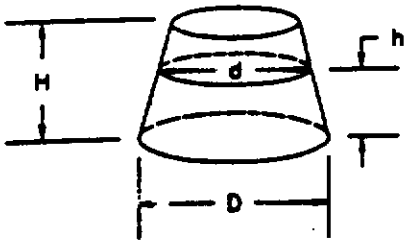
FIGURE 2b – VARIOUS VOLUME CALCULATIONS (cont'd.)

FRUSTUM OF A CONE

Case 1



Case 2



Total Volume

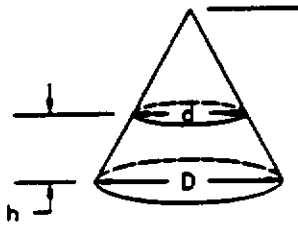
$V = \pi/12\ H(D_1^2 - D_1 D_2 - D_2^2)$

Partial Volume

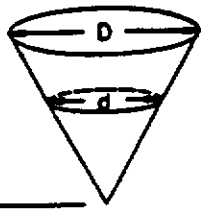
$V = \pi/12\ h(D_1^2 - D_1\ d + d^2)$

CONE

Case 1



Case 2



Total Volume

$V = \pi/12 \cdot D^2 H$

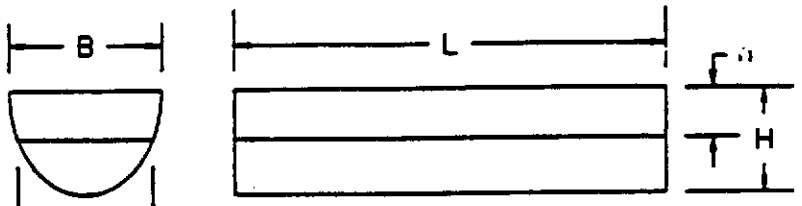
Partial Volume <u>Case 1</u>

$V = \pi/12 \cdot d^2 h$

Partial Volume <u>Case 2</u>

$V = \pi/12 \cdot (D^2 H - d^2 h)$

PARABOLIC CONTAINER



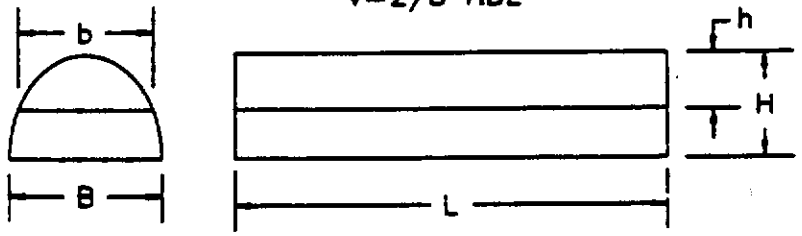
Case 1

Partial Volume

$V = 2/3\ hdL$

Total Volume

$V = 2/3\ HDL$



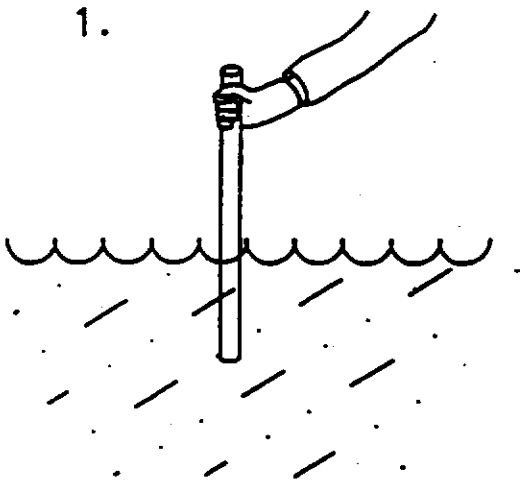
Case 2

Partial Volume

$V = 2/3\ (HD - hd) \cdot L$

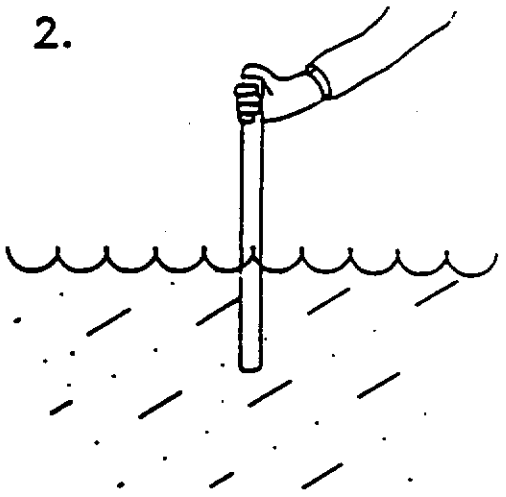
FIGURE 2c – GLASS THIEF

1.



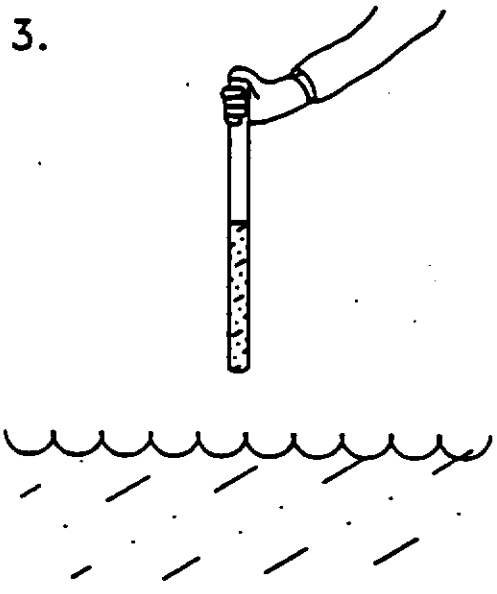
Insert open tube (thief) sampler in containerized liquid.

2.



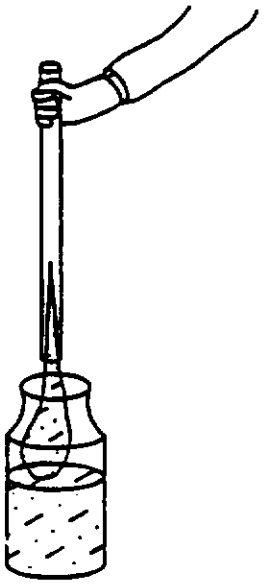
Cover top of sampler with gloved thumb.

3.



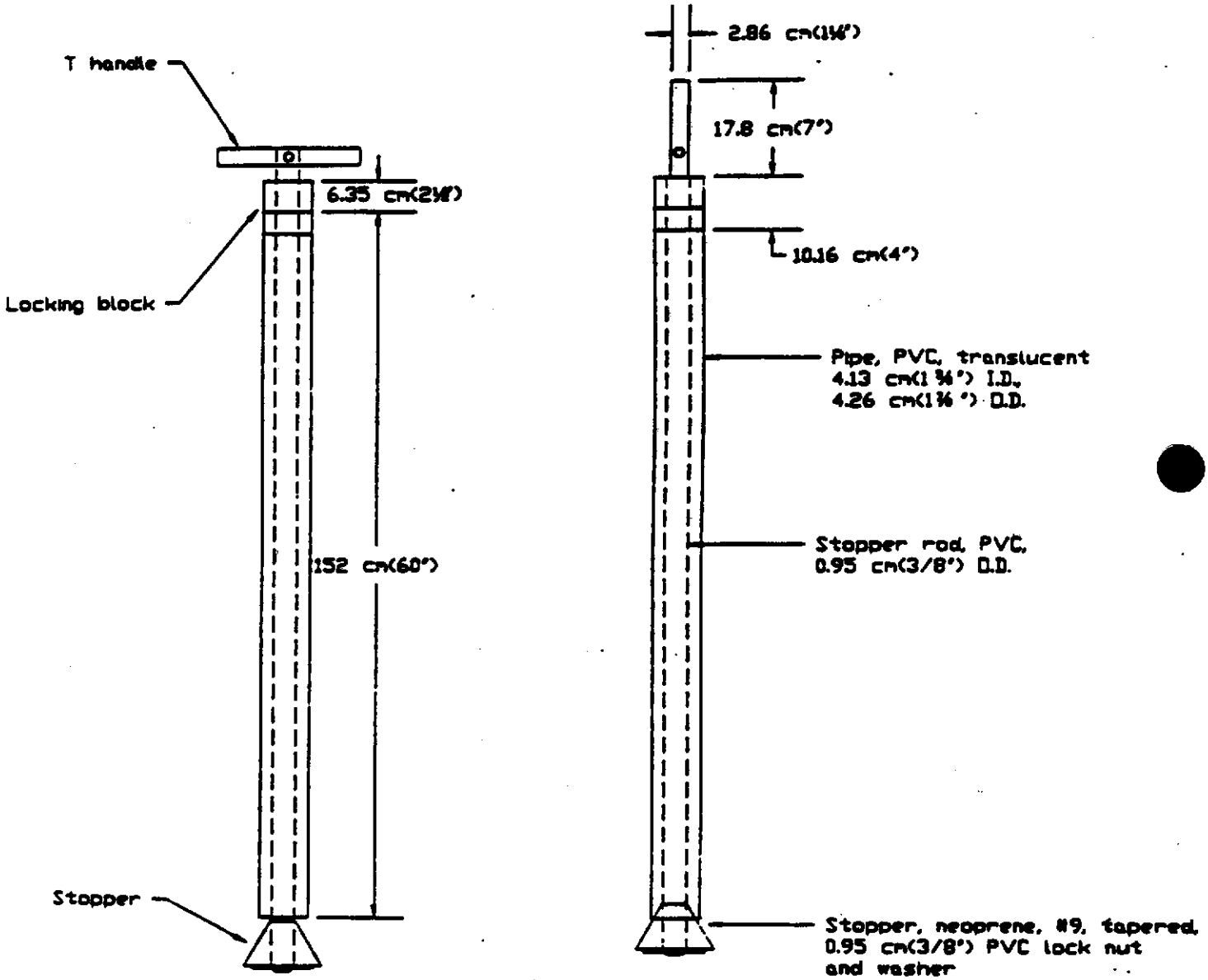
Remove open tube (thief) sampler from containerized liquid.

4.



Place open tube sampler over appropriate sample bottle and remove gloved thumb.

FIGURE 2d – COLIWASA (Complete Liquid Waste Sampler)



SAMPLING POSITION - CLOSED POSITION

FIGURE 2e – BACON BOMB

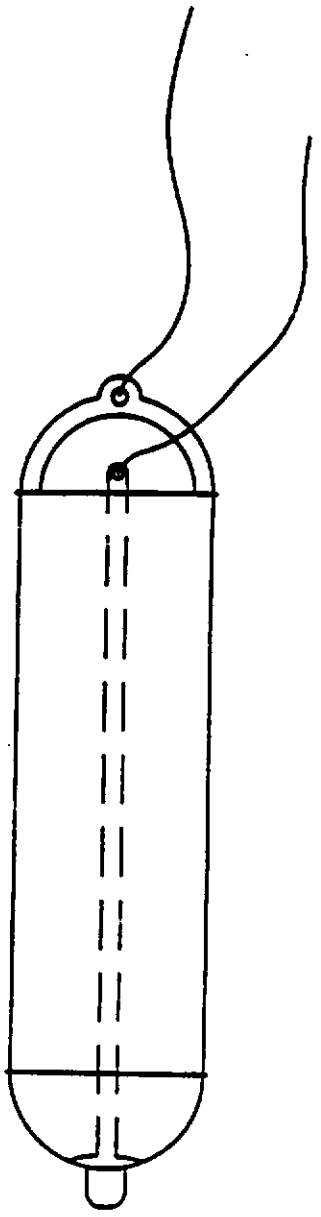


FIGURE 2f – SLUDGE JUDGE

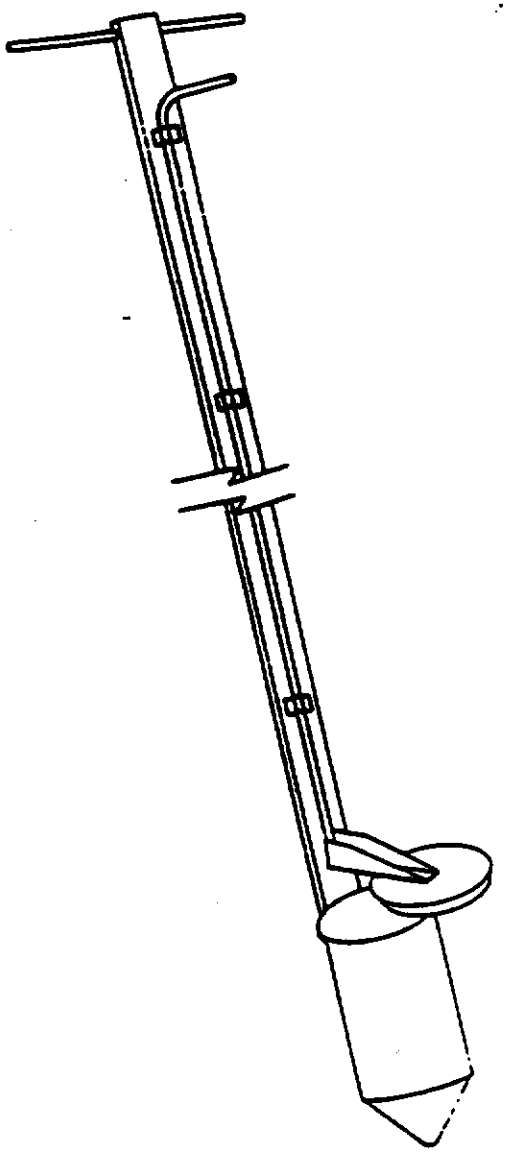


FIGURE 2g – SUBSURFACE GRAB

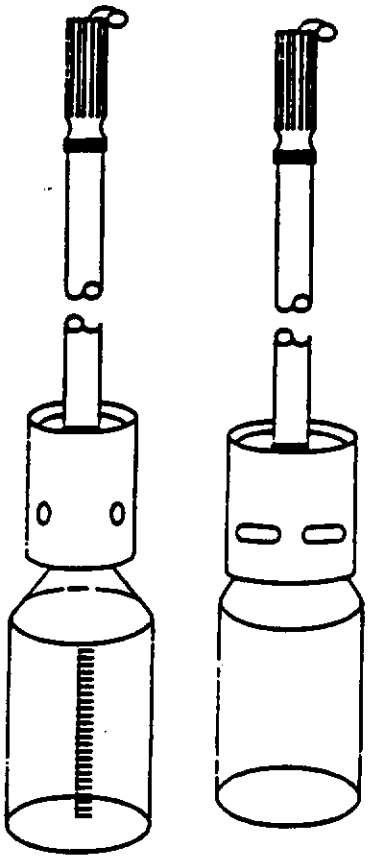


FIGURE 2h – BAILER

SECTION III: CONTAINER SAMPLING

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SECTION III: CONTAINER SAMPLING

DEFINITION OF CONTAINER

Any portable device in which a (liquid or solid) material is stored, transported, treated, disposed of, or otherwise handled. Containers include 55 gallon or smaller drums, dumpsters, tanker trucks or trailers, totes, bags, sacks, jugs, cans, bottles, and vials, among others.

DANGER: ***The opening of closed containers is one of the most hazardous site activities. Maximum efforts should be made to ensure the safety of the sampling team. Proper protective equipment and a general wariness of the possible dangers will minimize the risk inherent to sampling operations. Employing remote drum opening techniques and equipment whenever feasible is highly recommended.***

A. REMINDER CHECKLISTS

1. Pre-Sampling Activities

___ Assess site hazards, and develop and/or review a safety plan.

___ Develop and/or review sampling plan.

___ Establish purpose(s) of sampling.

___ Obtain necessary sampling and monitoring equipment, decontaminate or pre-clean the equipment, and ensure that it is in working order.

___ Bring enough clean water for rinsing, cleaning, and cooling off.

___ Schedule lab time and order your bottles 2 weeks in advance.

___ Be aware of OSHA requirements, and prepare for the dangers in moving, opening and closing containers.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the sampling trip to ensure all sampling team members understand the site safety plan, and their roles and responsibilities.

___ If necessary, contact the site owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of sampling event, and to address any safety and security concerns at the site.

___ Identify local suppliers of sampling expendables (e.g., ice, plastic bags), and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept).

___ Re-assess site hazards, weather (including wind direction), and access control at facility location before sampling.

___ Examine containers for visual cues as to contents, e.g., _____bulging, stains, ____labels, ____symbols, ____marks, ____container construction, ___effects on adjacent ground (Be aware that a drum's label may not describe its contents).

___ Consult chemical guidebooks, available company personnel, Health and Safety Unit personnel, Material Safety Data Sheets, etc., for additional information.

___ Prepare your sample containers prior to sampling (label and organize).

2. During Sampling Activities

___ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

___ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.

___ Never composite VOC samples.

___ If necessary, monitor the air where sampling is taking place so that you can adjust your level of protection.

___ Label (using a paint stick) each container with unique I.D. number.

___ Record descriptions of containers and their contents, their volume, and describe samples, in container log or in field notes.

___ Photograph containers in their original positions, and photograph samples.

___ Wipe off outside of sample bottles prior to placement in cooler.

___ Keep sample bottles in coolers properly preserved, sealed, and maintain chain of custody.

___ Re-evaluate, and if necessary, modify the site safety plan and your procedures if conditions change, problems develop, or additional hazards are discovered while on site for sampling.

___ Halt all sampling activities at the site if an accident or injury occurs, or conditions become too dangerous.

3. Post-Sampling Activities

___ Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety plan. Return all reuseable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.

___ Keep samples cool: ship or drop off to appropriate laboratory.

___ Separate incompatible wastes so that they are not transported in the same cooler.

___ Keep water reactive wastes separated from water or ice.

___ Seal odorous wastes in the cooler to avoid breathing vapors or odors during transportation.

B. EQUIPMENT CHECKLIST

See the attached sampling equipment checklist for a list of the equipment used for sampling containers.

SAMPLING EQUIPMENT CHECKLIST:
CONTAINERS

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book

PROJECT MANAGER:

_____Field Logbook
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera, with new or spare batteries
_____Pencils & Pens
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves_____L_____XL
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water
_____Cellular phone

GENERAL SAMPLING EQUIPMENT:

_____Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
1/2-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____pH/Temp/Millivolt Meter
    _____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes
_____TVA

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Field Chairs
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape

CONTAINER SAMPLING:

_____4 ft. ,3/8" dia., clean glass tubes
_____Non-sparking brass or beryllium bung wrench
_____Protective shields (or long handled bung wrenches)
_____Brass drum cutter
_____Absorbent pads
_____Sealer for holes cut in drums
_____Socket wrenches
_____Screwdrivers
_____Pliers
_____Adjustable wrenches
_____Rubber mallet
_____Paint sticks

C. PROCEDURES

1. Types of Drums

The 55-gallon drums you sample will normally be of two types, drums with only bung openings, and drums of the open head type. Open head type drums may also have bung openings. Drums with bung openings only normally contain liquid. Open head type drums normally are used to containerize solids, but can contain liquids as well. Overpack drums are used to contain standard sized 55-gallon or smaller drums that are leaking or damaged. The material the drums are constructed of can also give you clues as to their contents. There are steel, plastic, steel lined with plastic liners, stainless steel and other metal, and fiber drums. Polyethylene or PVC drums, or drums with these types of liners, often contain strong acids or bases. Fiber drums are used to contain dry solids of various characteristics. Exotic metal drums (aluminum, nickel, stainless steel) are very strong and expensive, and are often used to contain extremely dangerous materials. Single walled drums used as a pressure vessel have fittings for the storage product and for an inert gas. These drums may contain reactive, flammable, or explosive substances. Lab pack drums contain a variety of smaller containers within, and may contain incompatible materials, radioisotopes, shock sensitive, or highly volatile, corrosive, or toxic exotic chemicals. Lab packs, or other drums, suspected of containing radioactive, air or water reactive, shock sensitive, or explosive wastes, must not be handled without specialized assistance from the Agency's Health and Safety Unit, and/or an Agency contractor. Gas cylinders of any type or size are not to be opened or sampled.

2. Sampling Liquids in Drums Through Bungs

While taking all the necessary safety precautions, and wearing all the necessary protective gear, you and your sampling partner can sample liquid in sealed drums (through bungs- the small, round stoppers in the round openings on the tops of drums) by the following method:

a. If it can be done safely, and without causing a leak or spill, position the drum so that the lid and bung(s) are facing up.

   i. Remember to mark an identification number on the drum with your paint stick.

   ii. Before you reposition for sampling a drum that was lying on its side, or was upside down, make sure you have a photograph of the drum in its original position.

b. While staying clear of the bung opening, and using appropriate shields, and/or bung wrench handle extensions, slowly loosen the bung with a non-sparking bung wrench, allowing any gas pressure to release slowly. Leave the immediate area and go upwind while any gas is venting. If visible fumes or vapors are emitted upon opening drums of corrosive wastes, immediately

seal the drum back up, and/or leave the area, as appropriate. Return when it is safe to do so.

i. Maintain continuous air monitoring in the work area for both organic and inorganic vapors so that you can adjust your level of respiratory or dermal protection as necessary. Monitoring the air in the head space of the drum will help you characterize the general nature of the drum's contents.

ii. Do not apply excessive force to a bung if it is too tight. You do not want to break the bung or your wrench, and you do not want to create a spark that will ignite any vapors in or around the drum.

iii. Try to open one of the other bungs in the lid, if necessary. Move on to sample another drum if needed. Your safety is more important than any sample.

iv. Using the brass drum cutter to cut a sampling hole is a last resort to be used only if it is safe to do so, and if you can seal the hole back up.

c. Place an absorbent pad on top of the drum to absorb any spills that occur while withdrawing the sample.

d. Insert a clean glass tube into the drum as far as it will go without breaking, and withdraw the tube while holding your gloved thumb over the top end of the tube.

i. Attempt to get a complete cross section of the drum's contents within the tube.

ii. Note the depth, appearance, and any stratification of the liquid within the tube.

iii. Before you start placing sample into a jar, let some of the waste drip onto some pH paper to check the pH. Adjust your handling of the waste accordingly.

iv. If any waste has dripped or leaked onto any water pooled on the lid of the drum, or on the ground, note if the waste is miscible or not. Do not deliberately drip or add unidentified waste to water, as it may react violently.

v. Don't let the liquid spill off or out of the tube onto the ground, or run down your arm.

vi. Let any excess liquid from the tube fall back into the drum. The absorbent pad can catch drippage also.

vii. Your sampling partner will have to hold the open sample jar close to the end of the tube after you withdraw it from the drum.

viii. Carefully release the contents of the tube into the jar by removing your thumb slowly from the top end of the tube.

ix. If solids plug up the end of the tube so that the liquid can not be released, tap the end of the tube gently inside the sample jar until the plug releases.

e. After obtaining enough sample for your sample jars, close the jars, and discard the used tube into an empty container that can later be sealed. Discarding the used tube into the container that was sampled may be an option if the facility receiving the wastes does not object.

i. Don't combine incompatible, contaminated glass tubes, or other incompatible discarded materials in the same container.

ii. Discard your absorbent pads in the appropriate manner.

f. Reseal the drum as soon as possible after the contents are sampled.

3. Sampling Solids in Open Head Type Drums

While taking all the necessary safety precautions, and wearing all the necessary protective gear, you and your sampling partner can sample solids in sealed open top type drums by the following method. The contents of open drums of any type, of open head type drums whose contents can only be accessed through the bung holes, of dumpsters, etc., can be sampled using variations of the above and following techniques. Heed all of the appropriate safety precautions and warnings previously described for sampling liquids in drums through bungs.

a. Position the drum so that the top of the drum is facing up. If there is a bung in the lid you can open, open it slowly to release any pressure. Carefully remove the clincher ring, and then the lid.

b. Maintain continuous air monitoring so that you can adjust your level of protection as necessary.

c. Insert a glass tube into the solid as far as it will go without breaking, and withdraw the tube. This may allow you to observe any stratification that exists within the solid, or if it is homogenous or heterogenous in nature. You have to take a sufficient number and distribution of samples to adequately address the variation in the waste within the drum.

d. Collect your sample by inserting a clean stainless steel spoon, or other suitable scooping device into the waste, withdrawing it, and scraping the waste into the sample jar held by your sampling partner. Close the jars when you have collected an adequate volume of sample.

e. Place your chemically contaminated, and compatible, sampling tools and other discarded materials in a bag or container for later decontamination, or proper disposal.

f. Reseal the drum as soon as possible after the contents are sampled.

4. Sampling Smaller Containers

The same sampling techniques used for liquids or solids in drums can be used for sampling smaller containers. With homogenous wastes (i.e., wastes having a uniform composition throughout) in smaller containers, you may be able to pour the contents into the sample jar. This should only be done if you can obtain a representative sample this way, and the lifting or pouring of the container will not jeopardize your safety, or result in a spill. Heed all of the appropriate safety precautions and warnings previously described for sampling liquids in drums with bungs.

5. Sampling Portable Tanks

Sampling liquids in tanker trucks (which are defined as containers because they are portable) presents unique problems. If the tanker or tanker compartment is small enough, you may be able to use glass tubes in a manner similar to that for drums. Heed all of the appropriate safety precautions and warnings previously described for sampling liquids in drums with bungs. If the tanker or compartment is too deep for the glass tube technique, you will have to utilize the techniques and tools described for sampling tanks described elsewhere in this manual. Those techniques should allow you to account for the potential stratification of the waste..

D. REFERENCES

"Samplers and Sampling Procedures for Hazardous Waste Streams", USEPA 01/80.

"Test Methods for Evaluating Solid Waste, Volume II: Field Manual", SW846, USEPA11/86.

"Characterization of Hazardous Waste Sites-A Methods Manual, Volume 1-Site Investigations", USEPA 04/85.

"Sampling Procedures Manual", IEPA, DLPC, 04/83.

Sampling for Hazardous Materials, USEPA Environmental Response Training Program, 04/95.

E. FIGURES

3a -- Bung Wrench

3b -- Glass Thief (Tube)

FIGURE 3a – BUNG WRENCH

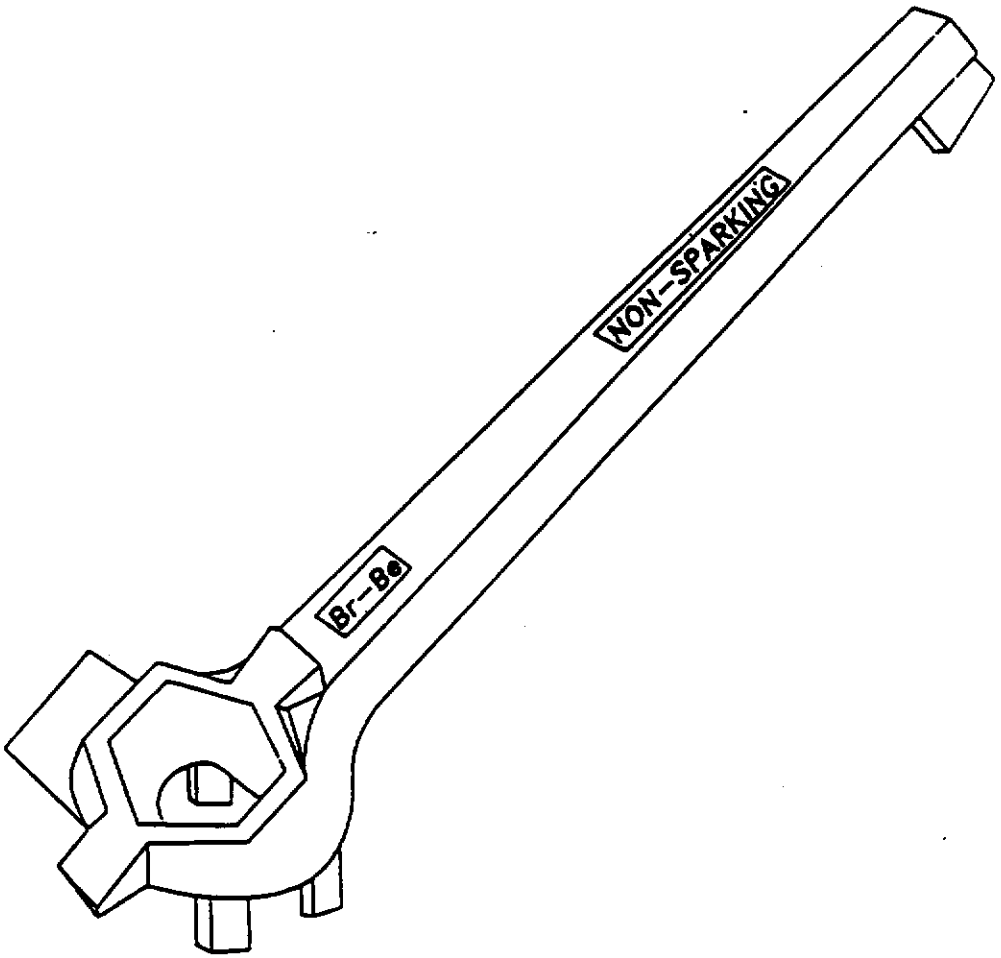
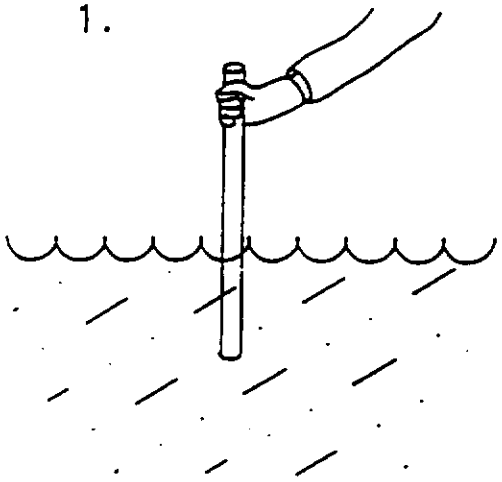


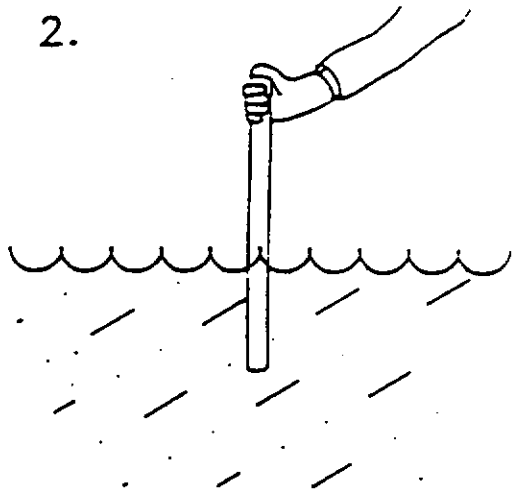
FIGURE 3b – GLASS THIEF (TUBE)

1.



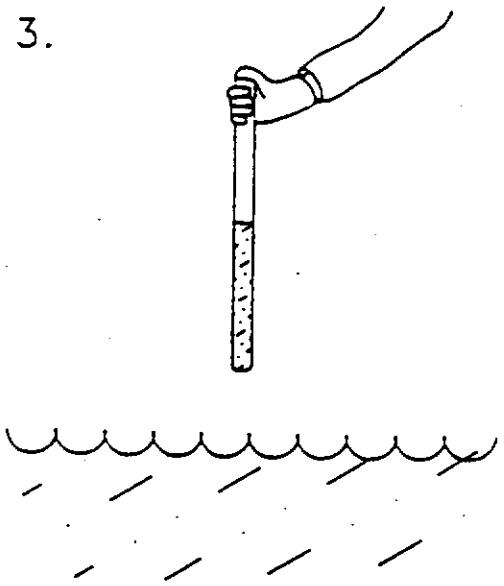
Insert open tube (thief) sampler in containerized liquid.

2.



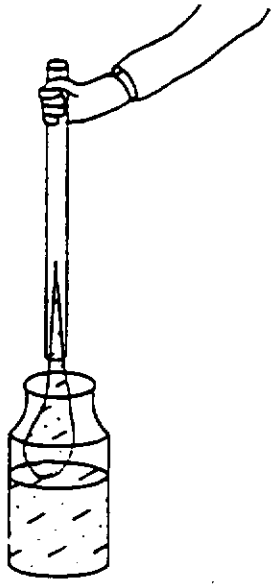
Cover top of sampler with gloved thumb.

3.



Remove open tube (thief) sampler from containerized liquid.

4.



Place open tube sampler over appropriate sample bottle and remove gloved thumb.

SECTION IV: SURFACE IMPOUNDMENT SAMPLING

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SECTION IV: SURFACE IMPOUNDMENT SAMPLING

A. REMINDER CHECKLISTS

1. Pre-Sampling Activities

___ Assess site hazards and develop and/or review a safety plan.

___ Develop and/or review a sampling plan.

___ Establish purpose(s) of sampling.

___ Obtain necessary sampling and monitoring equipment; decontaminate or preclean the equipment, and ensure that it is in working order.

___ Bring enough clean water for rinsing, cleaning, and cooling off.

___ Schedule lab time and order your bottles 2 weeks in advance.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.

___ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept.).

___ Become familiar with the impoundment, such as where the waste enters the unit, where the waste exits the unit (if applicable), and accessibility to the unit.

___ If sludge samples are required, refer to Section XI of this document for additional guidance.

___ Prepare your sample containers prior to sampling (label and organize).

2. During Sampling Activities

___ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

___ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.

___ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.

___ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.

___ Never composite VOC samples.

___ Wipe off outside of sample bottles prior to placement in cooler.

___ Sample bottles with preservatives cannot be overfilled (liquid samples).

___ Photograph sample containers at sample location.

3. Post-Sampling Activities

___ Decontaminate all field equipment and PPE, if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.

___ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with BOL SOP for Sampling Packaging and Shipping.

___ Separate incompatible wastes so that they are not transported in the same cooler.

___ Seal odorous wastes in the cooler to avoid breathing vapors or odors during transportation.

B. EQUIPMENT CHECKLIST

The selection of the sampling devices should be based upon waste properties (e.g., liquid or solid), site factors (e.g., waste accessibility, waste generation practices, and degree of hazard), and the analytes to be quantitated (e.g., VOCs or heavy metals). Ease of use under the site conditions and the degree of hazard associated with using a given device should also be considered. Refer to the following table to determine equipment needs.

SAMPLING EQUIPMENT CHECKLIST: SURFACE IMPOUNDMENTS

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book

PROJECT MANAGER:

_____Field Logbook
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera
_____Camera Battery
_____Pencils & Pens
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves_____L_____XL
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water

GENERAL SAMPLING EQUIPMENT:

_____Sample Bottles
_____Clean Glass Tubes
_____Extra Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
1/2-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____TVA
_____pH/Temp/Millivolt Meter
_____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Field Chairs
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape

SPECIFIC SAMPLING EQUIPMENT:

_____Disposable Dippers

C. PROCEDURES

Note: These procedures should be also followed when collecting liquid and sludge samples from a test pit. The sample collector should also review Section IX (Surface Water) for additional information on liquid sampling procedures.

Make sure appropriate protective gear is worn and all necessary safety precautions are taken prior to collecting samples.

1. Liquid Sampling

Most liquid samples are grab samples and are collected by immersing the dipper in the impoundment. A sample of a dipper can be seen on Figure 4a.

Note: Samples for VOC analysis are collected first. When obtaining samples for volatile organic analysis, it is important to exclude any air space in the top of the bottle.

Note: To sample a pond or other standing body of water, the surface area may be divided into grids. A series of samples taken from each grid is combined into one sample, or several grids are selected at random. To conduct this type of sampling, a boat might be necessary, which is not available in the Bureau of Land.

a. Position yourself to collect sample without taking any unnecessary risks.

b. Holding the end of the rod opposite the dipper, lower dipper until it is completely below the surface (or to a specific depth) and collect grab sample.

c. Transfer grab sample to appropriate sample container, continuing until you have collected the necessary number of samples for this location.

d. Remove dipper from the rod and place dipper in a trash bag.

e. Decontaminate the end of the rod, if necessary.

f. Move to the next sampling location.

g. Attach another dipper and repeat steps (a) through (e).

2. Sludge Sampling

Refer to Section XI (Sediments).

D. REFERENCES

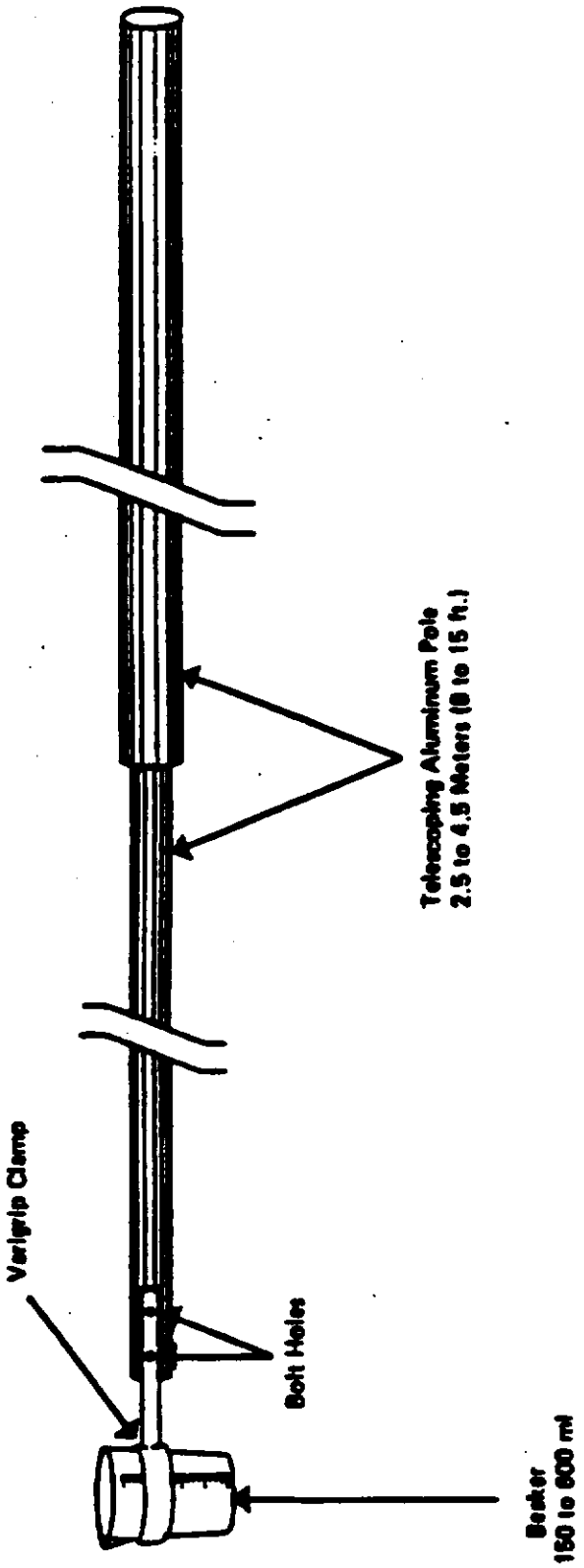
Illinois Environmental Protection Agency, Remedial Project Management Section. Methods & Procedures Manual for Activities Undertaken Under the Preliminary Assessment/Site Inspection Program, 1987.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Volume II, Third Edition.

E. FIGURE

4a -- Disposable Dip Sampler

FIGURE 4a -- DISPOSABLE DIP SAMPLER



SECTION V: WASTE PILE SAMPLING

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SECTION V: WASTE PILE SAMPLING

A. REMINDER CHECKLIST

1. Pre-Sampling Activities

___ Establish purpose(s) of sampling.

___ Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.

___ Assess site hazards, and develop and/or review a safety plan.

___ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.

___ Bring enough clean water for rinsing, cleaning and cooling off.

___ Schedule lab time and order your bottles two weeks in advance.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.

___ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local fire Dept.).

___ Prepare your sample containers prior to sampling (label and organize).

2. During Sampling Activities

___ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

___ Collect samples in order of volatilization. Special care must be taken when collecting VOC samples.

___ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.

___ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.

___ Never composite VOC samples.

___ Wipe off outside of sample bottles prior to placement in cooler.

___ Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.

___ Use stakes or flagging to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminants should be considered when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

3. Post Sampling Activities

___ Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e., IDW=cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.

___ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with BOL SOP for Sample Packaging and Shipping.

___ Separate incompatible wastes so that they are not transported in the same cooler.

___ Seal odorous wastes in a plastic bag and then in a cooler to avoid breathing vapors or odors during transportation.

___ Transcribe field notes to memorandum form and submit to the Bureau File. Include photographs and a sketch of site with sampling locations clearly identified.

B. EQUIPMENT CHECKLIST

See the attached sampling equipment checklist for a list of the equipment used for sampling waste piles.

SAMPLING EQUIPMENT CHECKLIST

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book

PROJECT MANAGER:

_____Field Logbook
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera and Battery
_____Pencils & Pens
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves_____L_____XL
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water

GENERAL SAMPLING EQUIPMENT:

_____Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
½-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____pH/Temp/Millivolt Meter
_____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes
_____TVA

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Field Chairs
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape

FOR WASTE PILES:

_____Tape Measure
_____Homogenization Bowl or Bucket
_____Spatula
_____Scoop
_____Plastic or Stainless Steel Spoons
_____Trowel
_____Continuous Flight Screw Auger
_____Bucket Auger
_____Post Hole Auger
_____Extension Rods
_____Sampling Trier
_____T-handle
_____Thin Wall Tube Sampler
_____Grain Sampler

C. PROCEDURES

1. Sampling With Shovels and Scoops

Collection of samples from surface portions of the pile can be accomplished with tools such as spades, shovels, and scoops. Surface material can be removed to the required depth with this equipment. Then, a stainless steel or plastic scoop can be used to collect the sample.

Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by sample team members. Use of a flat, pointed mason trowel to cut a block of the desired material can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most other applications. Care should be exercised to avoid the use of devices plated with chrome or other materials. Plating is particularly common with implements such as garden trowels.

Use the following procedure to collect surface samples:

a. Carefully remove the top layer of material to the desired sample depth with a precleaned spade.

b. Using a precleaned stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of material from the area which came in contact with the spade.

c. If volatile organic analysis is to be performed:

   1. Transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly. Fill container as full as possible to minimize air space.

   2. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.

   3. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.

4. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

2. Sampling With Augers and Thin-Wall Tube Samplers

This system consists of an auger, a series of extensions, a "T" handle, and a thin-wall tube sampler (Figure 5b). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The system is then lowered down the borehole, and driven into the pile at the completion depth. The system is withdrawn and the core collected from the thin-wall tube sampler.

Several augers are available. These include: bucket, continuous flight (screw), and post hole augers. Bucket augers are better for direct sample recovery since they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights, which are usually at 5-foot intervals. The continuous flight augers are satisfactory for use when a composite of the complete waste pile column is desired. Post hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy areas.

Use the following procedure for collection of waste pile samples with the auger:

a. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.

b. Clear the area to be sampled of any surface debris. It may be advisable to remove the first 3 to 6 inches of surface material for an area approximately 6 inches in radius around the drilling location.

c. Begin augering, periodically removing and depositing accumulated materials onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

d. After reaching the desired depth, slowly and carefully remove the auger from the boring. When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to Step j.

e. Remove auger tip from drill rods and replace with a precleaned thin-wall tube sampler. Install proper cutting tip.

f. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the pile. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring as the vibrations may cause the boring walls to collapse.

g. Remove the tube sampler, and unscrew the drill rods.

h. Remove the cutting tip and the core from device.

i. Discard the top of the core (approximately 1 inch), as this represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container. Sample homogenization is not required.

j. If volatile organic analysis is to be performed:

1. Transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly. Again, fill container as full as possible to minimize air space.

2. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.

3. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.

4. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

k. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps c through k, making sure to decontaminate the auger and tube sampler between samples.

3. Sampling With a Trier

This system consists of a trier and a "T" handle. The auger is driven into the waste pile and used to extract a core sample from the appropriate depth (Figure 5c).

Use the following procedure to collect waste pile samples with a sampling trier:

a. Insert the trier into the material to be sampled at a 0^{o} to 45^{o} angle from horizontal. This orientation minimizes spillage of the sample. Extraction of the samples might require tilting of the sample containers.

b. Rotate the trier once or twice to cut a core of material.

c. Slowly withdraw the trier, making sure the slot is facing upward.

d. If volatile organic analysis is to be performed:

    1. Transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly.

    2. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.

    3. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are being collected, place samples from the other sampling intervals into the homogenization container and mix thoroughly.

    4. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

4. Sampling With a Grain Sampler

The grain sampler is used for sampling powdered or granular wastes or materials in bags, fiber drums, sacks, similar containers or piles (Figure 5d). This sampler is most useful when the solids are no greater than 1/4" in diameter.

This sampler consists of two slotted telescoping brass or stainless steel tubes. The outer tube has a conical, pointed tip at one end that permits the sampler to penetrate the material being sampled. The sampler is opened and closed by rotation of the inner tube. Grain samplers are generally 24" to 40" long by ½" to 1" in diameter and are commercially available at laboratory supply houses.

Use the following procedures to collect waste pile samples with a grain sampler:

a. With the sampler in the closed position, insert it into the granular or powdered material or waste being sampled from a point near a top edge or corner, through the center, and to a point diagonally opposite the point of entry.

b. Rotate the sampler inner tube into the open position.

c. Wiggle the sampler a few times to allow material to enter the open slots.

d. With the sampler in the closed position, withdraw it from the material being sampled.

e. Place the sampler in a horizontal position with the slots facing upward.

f. Rotate the outer tube and slide it away from the inner tube.

g. If volatile organic analysis is to be performed:

    1. Transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly.

    2. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.

    3. Then either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.

    4. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

D. REFERENCES

Reproduced in part from OSWER Directive 9360.4-07, January 1991.

E. FIGURES

5a -- Scoops and Shovels

5b -- Sampling Augers

5c -- Sampling Trier

5d -- Grain Sampler

FIGURE 5a – SCOOPS AND SHOVELS

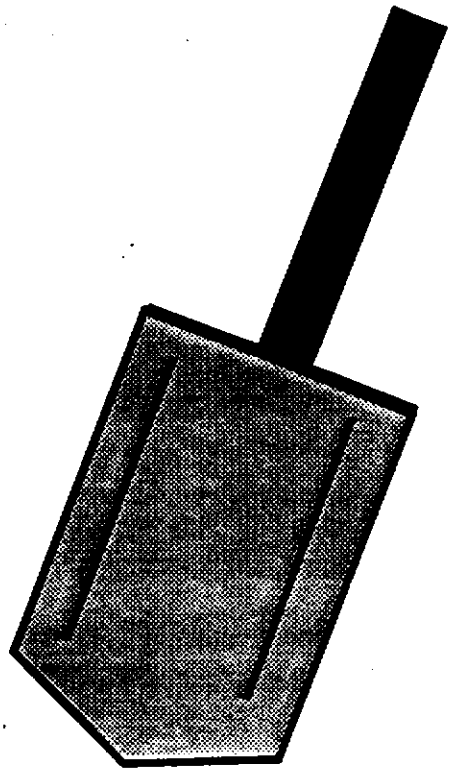


FIGURE 5b – SAMPLING AUGERS

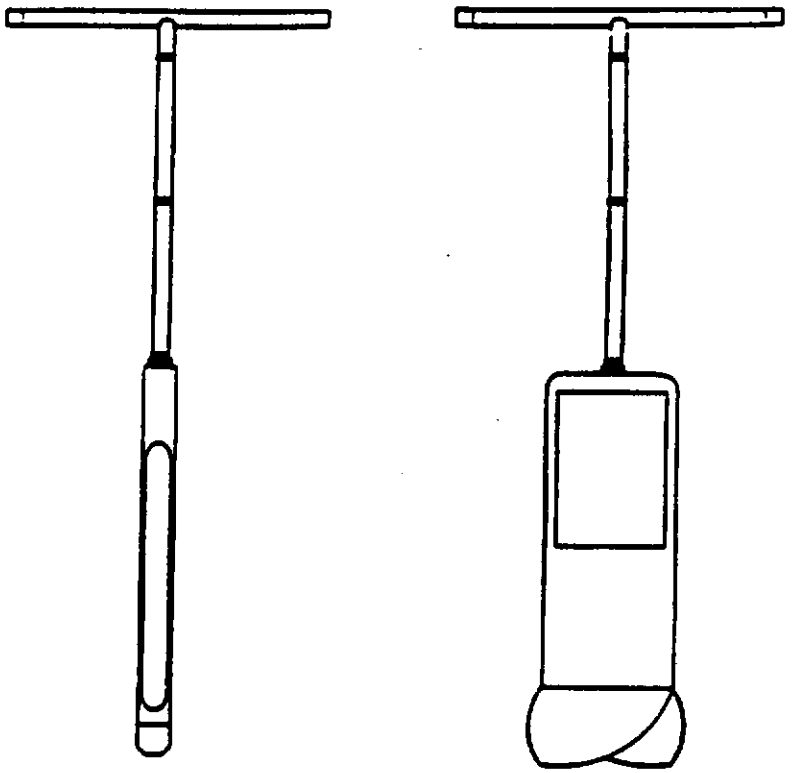


FIGURE 5c -- SAMPLING TRIER

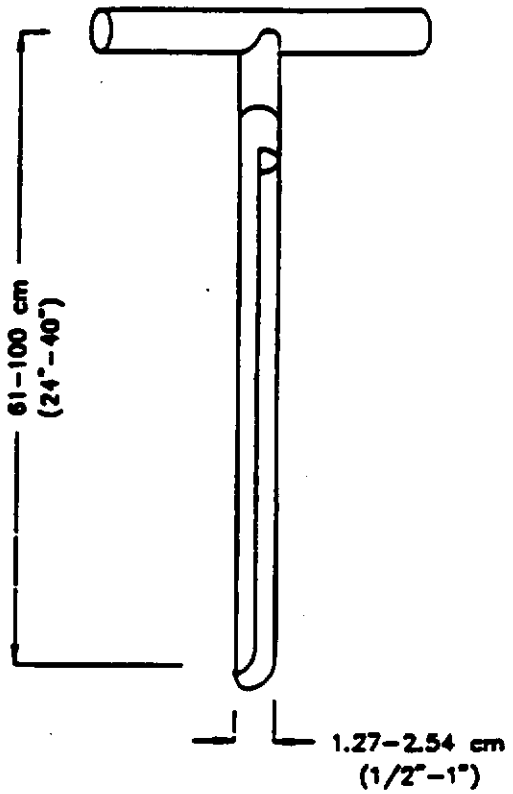
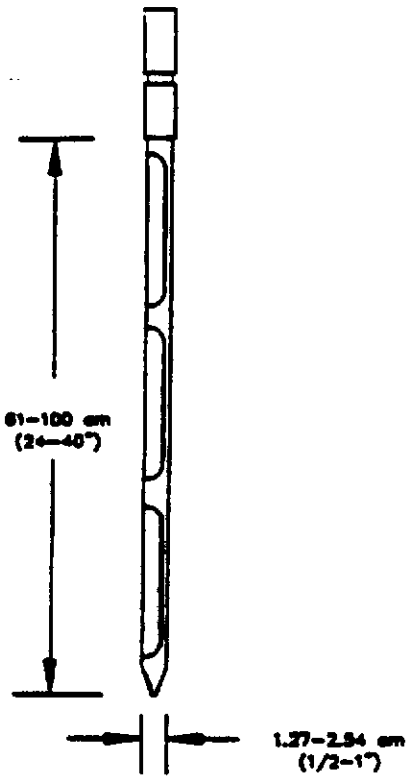


FIGURE 5d – GRAIN SAMPLER



SECTION VI: SOIL SAMPLING

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SECTION VI. SOIL SAMPLING

PREFACE

Soil samples may be recovered using a variety of methods and equipment. These are dependent on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type.

Surface soils may be sampled easily using a spade, trowel, and scoop. Near surface soil sampling may be performed using a hand auger, a power auger, drilling, or, if a test pit is required, a backhoe. The selection of the sampling devices should be based upon the cohesiveness of the soil and the chemical characterization or analytes of concern (e.g. VOCs or metals). The drilling or sampling methodology chosen should cause the least amount of disturbance to the subsurface materials. The introduction of foreign materials can change the physical, chemical and biological nature of the soils to be sampled.

The objective of subsurface sampling is to obtain representative samples of subsurface materials. The sample may be either composite or discrete, and either disturbed or undisturbed. The type of sample that is taken depends on the drilling technique and the purpose of the investigation. As the project manager, discuss the type of samples needed with the driller and all pertinent personnel to ensure that the objectives of the sampling episode are met. The sample handling procedures described here for surface soil sampling should be employed once a soil boring core is extracted from the ground. For more information on drill rig operations reference the "Drill Rig Unit Methods and Procedures Manual." Ms. Sherry Otto maintains a copy of this manual and she may be reached at 785-9384.

In some situations it might be best to drill two borings in close proximity; one to obtain soil samples for chemical analyses and the other for describing the physical characteristics of the soil Additional soil sampling during an investigation, beyond that for chemical contaminants, may be required to determine the physical characteristics of particular soil strata. In Illinois, the classification of groundwater often includes evaluating physical characteristics of water bearing soils. Groundwater classification significantly impacts cleanup objectives for both soils and groundwater in our state. Reference administrative procedure #26 for guidance on what physical attributes in soil affect the classification of groundwater.

Remember to follow all health and safety guidelines when handling samples. Environmental sampling may be the closest contact one will have with hazardous materials.

A. REMINDER CHECKLISTS

1. Pre-Sampling Activities

___ Establish purpose(s) of sampling.

___ Assess site hazards, and develop and/or review site safety plan.

___ Develop and/or review sampling plan.

___ Obtain necessary sampling and monitoring equipment; decontaminate or preclean the equipment, and ensure that it is in working order.

___ Prepare your bottles in advance of sampling (label and organize).

___ Bring enough clean water for rinsing, cleaning and cooling off.

___ Identify and stake all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations must be utility-cleared 48 hours in advance through J.U.L.I.E. at 1-800-892-0123 or in Chicago at 312-744-7000. When using the drill rig make sure that the rig will be at least 100 feet away from any overhead power lines (OSHA 29 CFR 1910.180) or notify the power company to turn off the lines.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the trip to ensure all sampling team members understand their roles and responsibilities.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.

___ Identify local suppliers of sampling expendables (e.g. ice, plastic bags) overnight delivery services (e.g. Federal Express), and recharge of SCBA air tanks; contact nearest public water supply that is contaminant free for drilling/cleaning of drill rig equipment, if necessary.

___ Prepare sample containers prior to sampling (label and organize).

2. During Sampling Activities

___ Perform a general site survey prior to site entry.

___ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs (directions and distances), any deviations from the original sampling plan, and any problems encountered.

___ Monitor the air in the area where sampling is taking place so that you can adjust your level of protection. Note: take special precautions around rotating augers. Never touch or reach behind a rotating auger. Make sure all sampling personnel know where the "kill switch" is on the drill rig.

___ Always take background samples from the same soil types and from similar depths.

___ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.

___ Never composite VOC samples.

___ Pack volatile samples to limit the amount of head space, but not too tightly; volatile contaminants may be squeezed out of the container.

___ Wipe off outside of sample bottles prior to placement in cooler.

___ Photograph sample container at sampling location.

___ Keep sample bottles properly preserved, sealed, in coolers on ice and maintain chain of custody.

3. Post-Sampling Activities

___ Decontaminate all field equipment, and PPE if appropriate, in accordance with the Health and Safety Plan. Clean or decontaminate all reusable equipment before returning to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e. IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.

___ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with the program specific standard operating procedure for sample packaging and shipping.

___ Separate incompatible wastes so that they are not transported in the same cooler.

___ Seal odorous wastes in plastic bags in a cooler to avoid breathing vapors or odors during transportation.

___ Transcribe field notes to memorandum form and submit to the Bureau File, include photographs and a sketch of site with sampling locations clearly identified.

___ When using the drill rig, within 30 days a well construction/geological report should be submitted to the Illinois Department of Public Health.

B. EQUIPMENT CHECKLIST

See the next page for a sampling equipment checklist for a list of the equipment used for sampling.

SAMPLING EQUIPMENT CHECKLIST

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book

PROJECT MANAGER:

_____Field Logbook
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera (film/battery)
_____Pencils & Pens (Waterproof)
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves_____L_____XL`
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water

GENERAL SAMPLING EQUIPMENT:

_____Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté
_____Tape Measure
_____Photoboard

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
1/2-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____TVA
_____pH/Temp/Millivolt Meter
    _____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Field Chairs
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners
_____Safety Glasses

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape
_____Vermiculite
_____Tie Wraps (for coolers)

FOR SOIL:

_____Survey Stakes or Flags
_____Stainless Steel Buckets, Pans or Bowls
_____Plastic Sheet for Cuttings/Spoils
_____Volatile Sampling Inserts
_____Wax or Foil to Seal Inserts
_____Tube Auger
_____Extension Rods
_____T-Handle
_____Pick Hammer

C. PROCEDURES

1. Soil Sampling by Hand

Collection of samples from surface soil (< 3 feet) can be accomplished with tools such as spades, shovels, and scoops. The surface material can be removed to the required depth with this equipment; then a stainless steel or plastic scoop can be used to collect the sample. This method can be used in most soil types but is limited to sampling near surface areas.

The use of a flat, pointed, mason trowel to cut a block of the desired soil can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most applications. In freezing conditions a pick hammer may to used to break through frozen ground. Care should be exercised to avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden implements such as potting trowels.

It is not recommended that VOC samples be collected at the surface, as these compounds probably have volatilized already; however, it may be acceptable to sample to determine the presence or absence of concentrations of volatile contaminants in the surface soil in spill situations where limited downward migration is expected. Volatile samples taken from a depth of 2 to 3 feet may more reliably represent contaminant conditions in a clay matrix.

a. Collecting surface soil samples (< 3 feet):

i. Remove grass/turf cover.

ii. Carefully remove the top layer of soil to the desired sample depth with a precleaned spade or stainless steel scoop.

iii. Using a precleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the shovel. Also remove as many roots as possible.

iv. Transfer sample into an appropriate sample container using a clean stainless steel or plastic lab spoon, or equivalent. If composite samples are to be collected, place the soil sample in a clean stainless steel or plastic bucket, tray or pan, and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then, place soil sample into labeled containers. Try to collect a sample that has as few roots and pebbles as possible. It is very important to remember to use a clean, i.e. decontaminated, scoop, spoon, trowel, bucket, tray, pan etc. for each sample and sampling

interval. Use of thoroughly decontaminated equipment will eliminate the possibility of cross contaminating samples.

Caution: Never composite VOC samples.

The risk of losing volatile contaminants is great when exposing the sample to air for a even a brief amount of time. If samples for volatile organic analysis will be collected, they need to be collected directly from the bottom of the hole (before mixing the sample if a non-volatile composite sample is to be collected), to minimize volatilization of contaminants. Quickly pack volatile samples into the sample containers to limit the amount of head space, but not too tightly. Volatile contaminants may be squeezed out of the sample and container if packed too tightly.

v. Fill the sample jar fully to the top to reduce headspace. Check that the Teflon® liner, if required, is present in the cap. Secure the cap tightly. Wipe off the outside of the jar prior to placing in cooler.

vi. Fill in the hole and replace grass turf if necessary. If the surface is contaminated, fill the hole with granular bentonite to prevent the movement of contaminants into the subsurface.

vii. Collect QA/QC samples as specified in sampling plan or quality assurance plan.

viii. Decontaminate equipment between samples according to BOL's SOP for Equipment Decontamination (to be developed).

b. Sampling at depth (3 to 10 feet) with hand augers

This system consists of a fully open or half open face bucket auger, a series of extensions, and a T-handle. The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The auger tip is then cleaned or replaced with a clean auger to prevent cross contamination, lowered down the borehole, and driven into the soil at the completion depth. The core is then withdrawn and the sample collected. The Agency also has posthole augers. Posthole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil. Posthole augers are most acceptable for composite sampling.

Collect samples with a hand auger as follows:

i. Attach the auger bit to a drill rod extension, and attach the T-handle to the drill rod.

ii. Clear the area to be sampled of any surface debris (e.g. twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the drilling location. A pick hammer may be necessary to remove the upper layer in freezing conditions.

iii. Begin auguring, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

iv. After reaching the desired depth, slowly and carefully remove the auger from the boring. When sampling directly from the auger, collect sample after the auger is removed from boring as described in step "vii."

v. Carefully lower the clean bucket auger (or tube sampler if soils allow) down the borehole. Continue boring with the bucket auger or gradually force the tube sampler into soil. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring, as the vibrations may cause the boring walls to collapse.

vi. Remove the auger from hole. Either unscrew the drill rods and from the auger and remove sample or remove soil core from the auger while rods are attached.

vii. When a cohesive substrate is being sampled, discard the top of the core (approximately 1 inch), as this represents material collected before penetration of the layer in question. Place the remaining core directly into the sample container or into a clean compositing pan or bowl. Minimize possible volatilization of VOCs by limiting agitation, exposure to air, and headspace. If you are compositing, mix thoroughly to homogenize the sample(s) as much as possible.

viii. Carefully and clearly label the container with the appropriate sample tag addressing all the sample packaging and shipping categories or parameters required by your program.

ix. Secure the cap tightly onto the sample container. If required for volatiles, ensure that a Teflon® liner is present in the cap. Wash off the sample container with deionized water. Place the sample bottle in a plastic bag, and put on ice to keep the sample at 4°C.

x. Use a chain-of-custody form to document the types and numbers of soil samples collected and logged. Verify that the chain-of-custody form is correctly and completely filled out prior to shipping.

xi. Record the time and date of sample collection, as well as a description of the sample and direction of any picture taken in the field logbook.

xii. If another sample is to be collected in the same hole, but at a greater depth, reattach the decontaminated auger bit or a different, clean auger to the rods and redo steps iii. through xi. Make sure to decontaminate the auger or tube sampler between samples to avoid cross contamination of samples.

xiii. Abandon the hole according to applicable regulations and guidance. Generally, shallow holes can simply be backfilled with the removed soil material.

2. Soil Sampling Using Power Tools

a. Auger Sampling

i. This method should **not** be used for VOC analysis.

ii. Examine the soil with an organic vapor instrument and record the reading.

iii. For noncohesive soils a sample can be collected from the auger cuttings. Cohesive soils may wrap around the auger and a sample can be collected from the auger. **NOTE: The augers must not be rotating and the drill rig should be in neutral. Make sure the drill rig operator knows what you are doing.**

iv. Using a clean stainless steel or plastic trowel or scoop, collect a sufficient quantity of soil from the auger or soil cuttings.

v. Transfer sample into an appropriate sample container with a clean stainless steel or plastic spoon, or equivalent. If composite samples are to be collected, place the soil sample into a clean stainless steel or plastic bucket, tray or pan and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then place the soil sample into the properly labeled containers. Try to collect a sample that has as few roots and pebbles as possible.

vi. Transfer the sample container(s) to a chilled cooler.

vii. Follow appropriate equipment decontamination and established IDW disposal procedures.

viii. Backfill the bore hole with granular bentonite to prevent cross contamination within the subsurface strata.

ix. Complete all necessary field documentation.

b. Split-Barrel (Tube) Sampling of Soils

i. The drill rig operator should follow the American Society for Testing and Materials (ASTM) standard method for penetration test and split-barrel sampling of soils D 1586.

ii. Examine the soil with an organic vapor instrument and record the reading.

iii. Using a clean stainless steel or plastic trowel or knife, collect a sufficient quantity of soil and place it into the appropriate sample containers. If composite samples are collected, place the soil sample into a clean stainless steel or plastic bucket, tray or pan and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then place the soil sample into the properly labeled containers.

iv. When sampling for VOCs, a clean stainless steel tube(s) can be placed inside the split-barrel sampler. Follow Administrative Procedure #14 on Soil Volatile Sampling Procedures.

v. Transfer the sample container(s) to a chilled cooler.

vi. Follow appropriate equipment decontamination and established IDW disposal procedures.

vii. Continue drilling and sampling as described in the sampling plan. Upon completion of boring, backfill the hole with granular bentonite to prevent cross contamination within the subsurface strata.

viii. Complete all necessary field documentation.

c. 5 Ft. Continuous Split Tube Sampling of Soils

i. The drill rig operator should follow any applicable American Society for Testing and Materials (ASTM) standards for use of this sampling device.

ii. Examine the soil with an organic vapor instrument and record the reading.

iii. Using a clean stainless steel or plastic trowel or knife, collect a sufficient quantity of soil and place it into the appropriate sample containers. If composite samples are collected, place the soil sample into a clean stainless steel or plastic bucket, tray or pan and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then place the soil sample into the properly labeled containers.

iv. When sampling for VOCs, a clean stainless steel tube(s) can be placed inside the split tube. Follow Administrative Procedure #14 for Soil Volatile Sampling Procedures.

v. Transfer the sample container(s) to a chilled cooler.

vi. Follow appropriate equipment decontamination and established IDW disposal procedures.

vii. Continue drilling and sampling as described in the sampling plan. Upon completion of the boring, backfill the hole with granular bentonite to prevent cross contamination within the subsurface strata.

viii. Complete all necessary field documentation.

d. Thin-Walled (Shelby) Tube Sampling of Soils

i. The drill rig operator should follow the American Society for Testing and Materials (ASTM) standard practice for thin-walled tube sampling of soils D1587.

ii. This method is not recommended for loose noncohesive soils such as sands and gravels.

iii. Examine the ends of the sample tube with an organic vapor instrument and record the reading.

iv. Add additional clay to the ends of the sample, if necessary, to eliminate head space and cover both ends of the sample tube with aluminum foil and a plastic cap.

v. Place the sample tube into a chilled cooler.

vi. Follow appropriate equipment decontamination and established IDW disposal procedures.

vii. Continue drilling and sampling as described in the sampling plan. Upon completion of boring, backfill the hole with granular bentonite to prevent cross contamination within the subsurface strata.

viii. Complete all necessary field documentation.

D. REFERENCES

Barth, D.S. and B.J. Mason, 1984, Soil Sampling Quality Assurance User's Guide, EPA-600/4-84-043.

U.S. Environmental Protection Agency. 1984. Characterization of Hazardous Waste Sites - A methods Manual: Volume II. Available Sampling Methods, Second Ed., EPA-600/4-84-076.

U.S. Environmental Protection Agency. 12/1987. A Compendium of Superfund Field Operations. EPA/540/p-87/001.

U.S. Environmental Protection Agency. 8/1990. Draft Generic Quality Assurance Project Plan for Region V FIT Activities, Volume 2, Standard Operating Guidelines and Standard Operating Procedures. Hazardous Site Evaluation Division, Field Investigation Team Zone II, Contract No. 68-017347.

U.S. Environmental Protection Agency. 3/1992. Technical Support Section Standard Operating Procedures. Draft, not available to the public.

E. FIGURES

6a -- Trowel (Scoop)

6b -- Tube and Bucket Augers

FIGURE 6a – TROWEL (SCOOP)

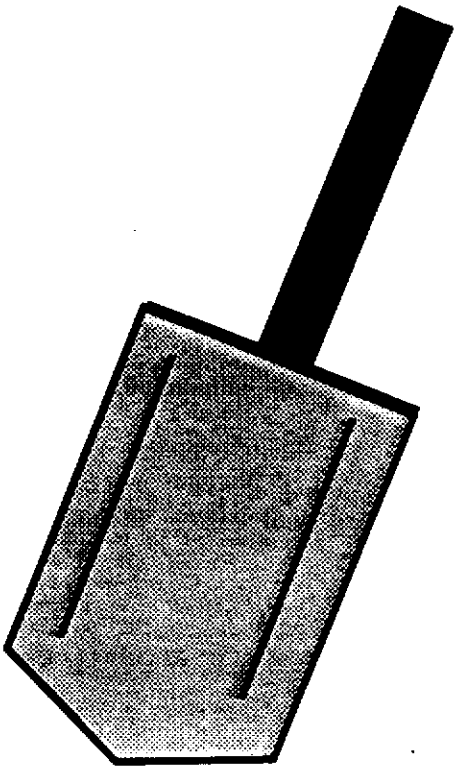
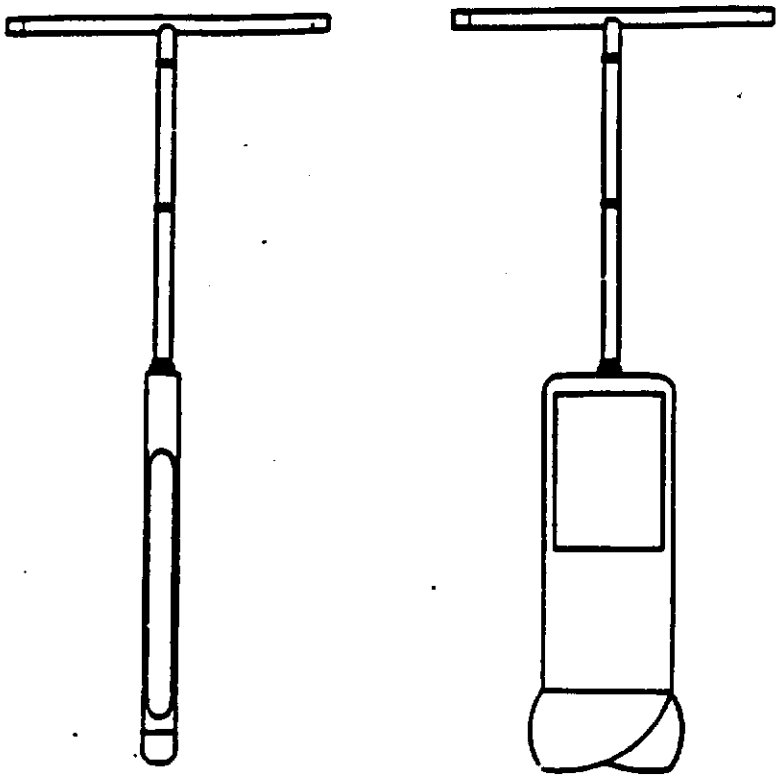


FIGURE 6b – TUBE and BUCKET AUGERS



SECTION VII. GROUNDWATER SAMPLING

CONTENTS

(Revised July 3, 2003)

SECTION VII. GROUNDWATER SAMPLING

A. REMINDER CHECKLIST

1. Pre-Sampling

__ Coordinate with the Office of Community Relations, if necessary.

___ Assess site hazards, and develop and/or review a site safety plan.

___ Develop and/or review sampling plan.

___ Establish purpose(s) of sampling.

___ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.

___ Bring enough clean water for rinsing, cleaning and cooling off.

___ Alert lab managers of your sampling event and order your lab-prepared bottles 2 weeks in advance.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site (and monitoring wells), to discuss the purpose of the sampling event, to address any safety and security concerns at the site, and to coordinate split samples if owner/operator requests.

___ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept.). ***If you ship samples, you must comply with all applicable shipping regulations!***

___ Review site geology, hydrogeology, monitoring well construction, potential contaminants and contaminant behavior.

___ Determine what QA/QC samples are necessary for the sampling objectives.

___ Determine if any private drinking water wells will be sampled in conjunction with the monitoring well sampling. Contact well owners in advance to schedule appointments.

___ Prepare (label and organize) your sample containers prior to sampling.

___ Prepare and bag wet ice for chilling samples or acquire dry ice.

2. Sampling Procedures

___ Document the sampling event. At a minimum, include weather conditions, date, time, samplers' names, photographs, any deviations from the original sampling plan, and any problems encountered.

___ Collect samples in decreasing order of volatility. Special care must be taken when collecting VOC samples (i.e., no headspace).

___ If necessary, monitor the air in the area where sampling is taking place and near the headspace of the monitoring well to determine your level of protection.

___ Keep samples properly preserved, sealed, and cooled, and maintain chain of custody.

___ Never composite VOC samples.

___ Wipe off outside of sample bottles prior to placement in cooler.

___ Package samples to prevent breakage during transportation.

3. Post-Sampling:

___ Decontaminate all field equipment and PPE if applicable, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (e.g., investigation derived waste or IDW = cuttings, rinse waters, bailers, baggies, contaminated PPE) and dispose of properly.

___ Chill samples with wet ice or in a refrigerator (sealed) prior to delivery to the labs. Wet ice (regular cubes) or dry ice are preferred in the summer because blue ice usually doesn't chill the samples down to 4^{o}C. Blue ice

may also contain contaminants such as methylene chloride and therefore should never come into contact with the VOC bottles.

___ Separate incompatible wastes so that they are not transported in the same cooler.

___ Seal odorous wastes in a cooler to avoid breathing vapors or odors during transportation.

B. EQUIPMENT CHECKLIST

See checklist below for appropriate sampling equipment.

SAMPLING EQUIPMENT CHECKLIST

PROJECT MANAGER:
_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chain of Custody Forms
_____Field Logbook
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera & Battery
_____Pencils & Pens
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____PPE Gloves
_____Evidence Tape
_____Watch
_____Dry Erase Board/Markers

PPE, SAFETY & SUPPORT:
_____Gloves: Nitrile, Latex, Butyl Rubber, or Neoprene
_____XL_____L_____M(gloves)
_____Cleaning & Cooling Water
_____Hand soap
_____Drinking Water
_____Gatorade
_____Field Chairs
_____Insect/Tick Repellant
_____Sunscreen
_____Raingear
_____First Aid Kit
_____Disposable Booties
_____Fire Extinguisher (1)
_____Walkie Talkies
_____Full-Face Respirator
_____Cartridges
_____SCBAs
_____Cylinders
_____Tyvek
_____Saranex
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Glove Liners
_____Telephone
_____Earplugs
_____Cellphone

FOR DECON:
Hand Spray Bottles:
_____Liquinox Solution
_____Distilled/Deionized Water
_____HCL: dilute to 5 or 10%
_____Nanopure(distilled/deionized)
5-Gallon Sprayers:
_____Liquinox Solution
_____Tap Water
_____Extra Gallons of DI Water
_____5-gal. Tap water (for pump decon)
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____Garbage Bags

FOR FIELD SCREENING:
_____CGI (e.g., Passport)
_____PID (e.g., H-nu or DL-101)
_____OVA
_____PID/FID (e.g., TVA)
_____Draeger Pump, Tubes
_____Radiation Detector
_____
_____

PURGING:

_____KEYS TO WELLS
_____Boltcutters, screwdriver,
_____Vice grip
_____Tool Box
_____Replacement Locks
_____Water level indicator (2)
_____3 AA batteries (for water level ind)
_____Paper towels
_____Machete
_____Visqueen (pre-cut)
_____Utility knife
_____Garbage bags
_____Purge pump & battery
_____Bailers
_____Nylon Cordage
_____5-gal. Plastic purge buckets
_____Stainless steel Weights (For unweighted PE bailers)
_____Backpack frame
_____Fishing gear:
___Treble hooks & weights, fishing line
_____Bungee cords
_____Flashlight & batteries
_____Fluorescent flagging
_____Disposable tubing for pump

SAMPLING:

_____Sample bottles
_____Extra bottle labels
_____Clear waterproof tape
_____Portable Table
_____pH paper
_____pH/SC (or mV)/Temp meter & 9-volt battery
_____Umbrella
_____Disposable polyethylene Bailers
_____Leachate Bailers

FILTERING:
_____Disposable filter cartridges:
-0.45 Micron
-5 Micron
_____Adapter Tubing: 3/8" ID by 1/8" EVA or reinforced rubber
_____Hose clamps for tubing
_____Quickfilter Transfer Vessel (2
_____Hand Pumps (2)
_____O-rings for vessel
_____Silicone tubing for peristaltic pump
_____Peristaltic Pump
_____Fuses: ½ & ¼ amp
_____Cords: ac and lighter plug
_____Turbidity Meter

SEALING & TRANSPORTATION:
_____Coolers
_____Blue Ice
_____Dry Ice
_____Wet Ice & Gallon Ziplocks
_____Large Food-grade plastic bags
_____Small VOC bags,
_____Quart Ziplock bags
_____Evidence Tape
_____COC Form
_____Bubble wrap

OTHER GENERAL SAMPLING EQUIPMENT:
_____Rain Canopy & Poles
_____Aluminum Foil
_____Binoculars
_____Shovel
_____Trowel/Sampling Spoons
_____Duct Tape
_____Fluorescent Marker Flags
_____Chest Waders
_____

C. PROCEDURES

1. Field QA/QC

a. Prevention of Cross-Contamination

1. Clean protective gloves (e.g., nitrile, latex, vinyl, neoprene, or other chemical resistant gloves preferably with low or no powder) will be worn when working with the water level indicator, bailers, pump, or any other equipment that comes into contact with groundwater. The gloves serve to prevent cross-contamination between wells and also to protect the sampler. Gloves will be discarded after each monitoring well and also if they become visibly contaminated or damaged during sampling.

2. Purging and sampling equipment that will be used in the monitoring wells should never be placed directly on the ground. Plastic sheeting ("Visqueen") should be placed on the ground near the monitoring well to provide a clean working area to place equipment and instruments and to prevent the suspension (if using a bailer) from accidentally touching the ground. This plastic sheeting is <u>not</u> for the sampling crew to step on. Bailer line should be kept off of the ground and off of the Visqueen by using an electric cord reel or looping the line around the thumbs as it is pulled out of the well. All equipment should be kept in its cover or container until it is time to be used. However, once used, it should not be placed back into its container or case until decontaminated.

b. QA/QC Samples

1. All QC measures should be performed for at least the most sensitive chemical constituents for each sampling date. These samples are collected, preserved and submitted for analyses as any other sample, for selected parameters. Analyte-free distilled and deionized (DI, hereafter), water or Nanopure water obtained from the organic lab must be used for field blanks. Background samples and VOC lab trip blanks are mandatory for every sampling trip unless there is no background well to sample or VOC samples are not being collected. Other appropriate QA/QC samples should be collected if needed. This must be coordinated prior to the site visit.

2. Document the QA/QC samples on the chain of custody form in the same fashion as your other samples.

3. Background Samples

A background sample should be collected from a monitoring well that is upgradient from the source of contamination that is the target of the investigation. Sometimes the well that has been designated as upgradient is not truly upgradient and sometimes this is not known until a review of the analytical results or field measurements has been conducted. The background sample should be collected from the same aquifer or zone being monitored by the downgradient monitoring wells.

4. Lab Trip Blanks (Mandatory)

Trip blanks are used as a control sample to determine potential VOC contamination from the containers themselves or the atmosphere during sample shipment and storage. They will accompany the sample bottles and samples at all times until they are delivered to the lab. All of the VOC samples and trip blanks must be kept in a separate cooler during sampling and until they are delivered to the lab. Trip blanks are not to be opened in the field. One set of VOC trip blanks (two 40ml vials) will be submitted with samples each day that samples are collected (USEPA, 1992) and for every 10 samples. For example, if 11 VOC samples are collected in one day, two sets of VOC trip blanks should be submitted to the lab. Label the trip blanks with the date they were used if turning in more than one day's worth of trip blanks.

5. Matrix Spike/Matrix Spike Duplicate ("MS/MSD;" Mandatory)

These are used by the laboratory to assess the amount of interference caused by substances other than those we're looking for. They must be collected for volatile, semi-volatile, pesticide, herbicide, and PCB analyses. They are collected simultaneously with the routine sample at the upgradient well or the well that is expected to be the least contaminated. The routine and MS/MSD portions of the sample are considered two separate samples and listed as such on the chain of custody, but they will share the same root sample number. The routine portion of the sample should be designated with a "-R" suffix and the QA/QC portion must be labeled with a "-QC" suffix. For example, label the routine sample "G101-R" and label it as a separate sample "G101-QC". The volume required various by parameter. For volatiles, collect an amount equal to the routine amount—e.g., if you have two vials, fill an extra two (total of four). For semivolatiles, pesticides,

herbicide, and PCBs, collect an extra amount equal to twice the routine amount. For example, if you fill one semivolatile bottle for routine, fill two more for MS/MSD. MS/MD samples are collected at a rate of one per up to twenty routine samples. Refer to the laboratory's guidance document for further information.

6. Field blanks (not mandatory, site-specific):

   A. Field Equipment Blanks (also referred to as method blanks, rinsate blanks)

      These are samples that are collected to verify the adequacy of decontamination efforts. The project manager should decide whether these blanks are needed. Whenever non-dedicated sampling equipment is used, equipment/field blanks should be collected. An equipment/field blank is obtained by passing analyte-free, DI water through a cleaned sampling apparatus (pump, bailer, filtration equipment, etc.) and collecting it in a clean sampling bottle. This blank is used to assess the effectiveness of the decontamination procedures implemented between sampling locations. Ideally, equipment blanks should be collected after sampling the well(s) that historically show(s) the highest levels of contamination. They should be collected at a frequency of one blank per 10 samples (Ohio EPA, 1995).

   B. Field (air) Blank

      To assess the potential contribution of airborne contaminants present in ambient air to groundwater samples being collected, use a pair of empty preserved VOC bottles and pour lab-prepared analyte-free DI or Nanopure water into then and submit like any other sample.

c. Calibration of Equipment

Personnel should read the instructions prior to using any of the instruments.

The pH/specific conductance (or mV/temperature) meters will be calibrated in the field once per day in accordance with the manufacturer's guidelines, which are to be kept with the equipment. This will be documented in the field notes. The meters(s) should be recalibrated if an apparent erroneous reading is obtained. If the meter cannot be recalibrated

to meet the manufacturer's accuracy specifications, repair may be necessary.

The direct-reading monitoring equipment (H-Nu, TVA, Passport, etc.) will also be calibrated according to manufacturer's specifications and this will be documented.

2. Approaching the Well

If driving a vehicle to the well, the vehicle must be turned off and the exhaust vapors allowed to dissipate before uncapping the well.

a. Open the protective outer casing of the well while standing crosswind or upwind from the well. The area in and around the headspace of the well will be monitored for organic vapors. Depending on the site-specific factors involved, one or more of the following instruments may be used: Toxic Vapor Analyzer (TVA), H-Nu or other PID, Passport, OVA or FID. The project manager must decide which instruments to use prior to the sampling event. The instruments must be maintained and calibrated in accordance with manufacturer's instructions.

b. After taking the reading of the air around the outer casing, remove the well cap. Place the instrument probe near the opening of the well and observe the response of the instrument. The response should be observed for approximately one to two minutes or until the reading stabilizes.

c. The type of response will be recorded as to whether it was immediate, gradual, or none. Record the units or percent (%) reading. If no reading above background is recorded, then proceed with the next activity. If a reading above background is encountered, it will be taken into consideration when determining the level of respiratory protection required. The level of protection to be used while approaching the well should be determined prior to the sampling inspection, especially in the case of a leachate monitoring well, which may have landfill gas emanating from it.

3. Inspecting the Well

Each well will be visually inspected and the physical integrity ascertained by touching the inner casing (while wearing protective gloves) to see if it moves. These observations will be documented. Factors to be verified in the inspection of the well are outlined on the attached monitoring well field inspection checklist (optional), included as Attachment 1. The condition of each well should be documented with a photograph.

4. Static Water Level & Total Depth Measurements

a. Static water level measurements in all wells are to be taken within the shortest possible time of each other, and prior to purging any wells.

b. Measurements are taken by starting at the least contaminated well and proceeding in order of increasing contamination. If no contamination has been detected in the past, or this information is not available, measure the (presumed) upgradient well(s) first.

c. If the wells have vented caps (the cap or inner casing has been drilled or notched, or the cap fits loosely enough that the air column in the well is in communication with the atmosphere), the water level measurements may be made as soon as the headspace has been monitored for organic vapors.

☞ If the wells caps are not vented, the water level must be allowed to stabilize to obtain accurate readings after removal of the cap. The time span required for the water level to stabilize could range from a few minutes to a few days, depending on the geologic material the well is screened in. Procedures 8.2.1 and 8.2.2 of the ASTM Standard D4750 describe how to determine a stabilized liquid level (these procedures may be obtained through the IEPA Library). If water level measurements will be used for calculating groundwater gradients and flow direction, the most accurate readings possible must be collected. For purposes of calculating well purge volume, allow the wells to stabilize 5 minutes.

d. If a dedicated bailer is being stored in the well (you should ask owner/operator about this prior to the site visit), you must do one of two things, depending on whether the bailer is stored above the water column or below. If the bailer is stored above the water column, remove the bailer and take your water level measurement. If the bailer is being stored below the water column, try to collect the static water level measurement prior to removal of the bailer. If this cannot be done, remove the bailer, let the water level stabilize, and take the water level measurement.

e. Water level measurements are taken with an electronic sounder/tape. Measurements are to be made to the nearest hundredth (0.01) of a foot, following these steps:

1. Set the sensitivity according to manufacturer's specifications (high for clean water, low for highly contaminated water or leachate).

2. Ensure that the probe of the water level indicator has been properly decontaminated prior to insertion into the well.

3. While wearing protective gloves, slowly lower the probe in the well until the buzzer sounds.

4. Raise the probe until the buzzer ceases.

5. Slowly lower the probe until contact is just made. Repeat this until a confident reading is obtained (measure it at least three times).

6. Holding the probe cable at the side of the inner casing, which serves as a reference point for measurements, note the point on the cable adjacent to the top of the inner casing.

7. Record the water level measurement.

✸The electric water level indicator will not respond to an oil layer floating on the water. Thus, the liquid level determined will be different than would be determined by a steel tape or an interface probe. The difference depends on how much oil is floating on the water (ASTM D4750). Also, the thickness of the LNAPL in the well does not always reflect the thickness on the water table.

8. In clean wells or wells with only dissolved contamination, the water level indicator may be used to measure the approximate total depth of the well (see next paragraph for contaminated wells. Lower the probe into the well with the sensitivity turned off. With the probe just touching the bottom of the well, measure the depth using the same procedure as for static water level measurements and record the measurement. This method of measurement is not accurate to the 0.01 foot. Keep in mind that the water level indicator is not intended to be an accurate way of measuring total depth, but may indicate if siltation has occurred.

☞ For highly contaminated wells, or leachate wells, **DO NOT LOWER THE WATER LEVEL INDICATOR PROBE BELOW THE LIQUID LEVEL.** Use a reusable stainless steel weight tied to a disposable suspension line, such as nylon cord, to detect the bottom of the well.

A. Slowly lower the weight into the well until the bottom is detected.

B. With the line taut, mark it against the reference point (top of inner casing) or grasp the line at that point and pull the line out of the hole and mark it where you are holding it.

Mark it with a China marker or other type of marker (this part of the line never touches the groundwater).

C. Recover the line and weight from the well and accurately measure the length of line below the mark.

D. Discard the line and thoroughly clean the weight before reuse.

9. Thoroughly clean the line and probe with a dilute Liquinox mixture and rinse with DI water as the line is being reeled out of the well (don't rinse the line after it has been rolled back onto the reel).

10. Change protective gloves between wells.

5. Calculation of Static Water Volume in Casing ✍

This section will describe three different methods to calculate the volume of static water in the well. One "well volume" or "casing volume" of water refers to the water standing in the inner well casing before it is purged. The following describes two methods of calculating the volume of static water in a well; one method uses a the radius of the well with a standard conversion factor of 0.163 (Method a); dividing by 6.13 (Method b); and Method c, which uses numbers from the Conversion Table.

a. <u>Method a. Equation for Volume of Static Water in Well Using Conversion Factor 0.163:</u>

$V = h * (r)^2 * 0.163$, and r may be excluded for a 2-inch well because radius = 1, so:

$V = h * 0.163$ (use this only for a 2-inch well)

Where:

V = One Casing Volume, which is the volume of static water in the well
h = height of water standing in the well (total depth minus depth to static water level)
r = radius in inches (leave out units); this is equal to ½ of the inner diameter of the inner well casing
0.163 = Conversion Factor accounting for pi (3.14) and all unit conversions, e.g., $inches^2$ to $feet^2$ and cubic feet to gallons .

Example:

- Diameter of well is 4-inches; therefore radius is 2 (exclude the units for the equation).
- Depth to static water level (measured from specified measuring point on the inner casing) = 25 feet.
- Total depth of well is 40 feet.
- h = height of water in the well, (40 ft - 25ft) = 15 feet.

$V = 15 \text{ ft} * (2)^2 * 0.163 = 9.8$ gallons

For a 2-inch well: $V = 15 \text{ ft} * (1)2 * 0.163 = 2.5$ gallons

b. Method b. For 2-inch wells: Dividing by 6.13

Conversely, for a 2-inch diameter well: you can divide the height of the water column in the well by 6.13 to determine the gallons of water in the well because there are 6.13 feet/gallon of water in a 2-inch well.

If the well has 2-inch diameter casing, you may use the right column of the Conversion Table*:

$V = h \div 6.13$ (constant standard for a 2-inch well).

Example:

Using the same information from the previous example (depth to water is 25 feet; total depth is 40 feet; therefore, h = 15 feet);

for a 2-inch diameter well:

$V = 15 \text{ ft} \div 6.13 \text{ gal/ft} = 2.5$ gallons, and;

Also, please note that the same answer is obtained using the equation from the previous method:

$V = h * 0.163$, (for a 2-inch well), so:

V = 15 ft. * 0.163 gal/ft = 2.5 gallons

The right hand columns of the Conversion Table gives the volume of water in a 2-inch diameter well and is based on the linear feet of water measured in the well.

c. Method c. Using a Conversion Factor from the Conversion Table:

V = h * Conversion Factor (from left side of table)

Where:

V = One Casing Volume, which is the volume of static water in the well
h = height of water standing in the well (total depth minus depth to static water level)
Conversion Factor = Chosen from the Conversion Table on the next page and is dependant on the radius of the well casing

Example:

Using the same information as described in Method a:

- Diameter of well is 4-inches; therefore radius is 2 (exclude the units for the equation), therefore;
- Conversion Factor chosen from Conversion Table is 0.653.
- Depth to static water level = 25 feet.
- Total depth of well is 40 feet.

h = height of water in the well, (40 ft - 25ft) = 15 feet.

V = 15 ft *0.653 = 9.8 gallons

Note: This is the same answer as obtained with Method a.

CONVERSION TABLE

Conversion Factors to Calculate Well Casing Volume (gallons)

Diameter of Casing or Hole (Inches)	Conversion Factor (Gallons per Foot)
0.5	0.010
1	0.041
1.5	0.092
2	0.163*
2.5	0.255
3	0.367
3.5	0.500
4	0.653
4.5	0.826
5	1.020
5.5	1.234
6	1.469
7	2.000
8	2.611
9	3.305
10	4.080
11	4.937
12	5.875
14	8.000
16	10.44
18	13.22
20	16.32
22	19.75
24	23.5
26	27.58
28	32.00
30	36.72
32	41.78
34	47.16
36	52.88

*Liner ft. of water in the well X .163 (2-in well) = Gallons of water in the well (One casing volume)

Gallons of Water in a 2-inch Diameter Well

Linear Feet of Water Column	Volume of Water (Gallons)
0.5'	0.08
1.0'	0.163
1.5'	0.245
2.0'	0.326
2.5'	0.408
3.0'	0.489
3.5'	0.571
4.0'	0.652
4.5'	0.734
5.0'	0.815
5.5'	0.897
6.0'	0.978
6.13'**	1.0
6.5'	1.06
7.0'	1.14
7.5'	1.22
8.0'	1.30
8.5'	1.39
9.0'	1.47
9.5'	1.55'
10.0'	1.63
10.5'	1.71
11.0'	1.79
11.5'	1.87
12.0'	1.96
12.5'	2.04
13.0'	2.12
13.5'	2.20
14.0'	2.28

**Linear feet of water column ÷ 6.13' (2-in well) = Gallons of water in the well (One well volume).

6. Purging

a. Why purge?

Purging is necessary in order to collect a groundwater sample that is representative of formation water. Water in storage within a well casing (above the screened interval) between sampling events is physically isolated by the well casing from ground water in the formation and cannot interact with "fresh" formation water and is considered to be "stagnant" (Nielsen, 1999). Changes in water chemistry in the cased portion of the well are caused by a variety of factors (Nielsen, 1999):

1. The presence of an air/water interface at the top of the water column, that can result in:

    - Creation of a dissolved oxygen concentration gradient (high to low) with depth.
    - Increased microbial activity because of the presence of dissolved oxygen.
    - Lower pH, due to increased dissolved carbon dioxide (CO2) at the top of the water column.
    - Loss of volatile constituents from the water column to the headspace in the well casing.

2. Interactions between the well casing and screen materials and ground-water in storage (leaching from, sorption to, or corrosion of the well construction materials)

3. Contribution of contaminants from sources above the static water level in the well including:

    - Condensation on the inside surface of the well casing.
    - Water from formations above the zone of interest leaking past joints or cracks in the casing.
    - Introduction of surface contamination as a result of failure of the surface seal(s) causing leakage into the well.

b. Purging Strategies

A bailer or pump may be used to purge the well of stagnant water (water in the casing above the screened zone). These procedures do not dictate what type of equipment to use for purging and sampling. That decision should be made ahead of time by the project manager.

Purging strategies vary in relation to the yield of the well and the position of the static water level relative to the well screen. Dewatering the screen and the gravel pack should be avoided to minimize aeration/oxidation effects on water chemistry, and to minimize turbulence and turbidity of the sample (Barcelona, 1985b; Kaminski, 1994; Nielsen, 1995; USEPA, 1992, pg. 7–8; USEPA, 1993, pg. B-5). In wells that have been purged dry, volatilization losses of 10 percent are likely in as little as five minutes as the recovering formation water trickles through the headspace in the dewatered sand filter pack. Losses may reach 70% for recovery periods of one hour. When the sand filter pack is drained by purging procedures, the sample should not be analyzed for volatile constituents since volatilization biases are likely to be substantial (McAlary and Barker, 1987).

Therefore, the water level should not be allowed to drop very far below the top of the screen during the purging process. Usually, the IEPA sampler will not know the yield capabilities of the well or the position of the water level prior to measuring and purging. The depth of the bottom of the bailer in relation to the depth of the top of the screen will need to be known and monitored. This can be accomplished by:

- Frequent measuring of the water level with the electronic water level indicator during purging, or;

- Calculating the depth of the screen from the top of the casing and tying a knot in the bailer cord to represent that depth (taking into account the length of the bailer). If depth to top of the screen is not known, make an estimation and tie a knot. In either case, the sampler then need only stop the knot from passing into the top of the casing in order to prevent dropping the water level below the top of the screen.

1. Low Yield Wells (the water level drops to the top of the screen while purging with a bailer) — If sampling for volatile organic compounds, the well should not be purged dry and the static water level should not be lowered very far below the top of the screen. To avoid dewatering the screened interval, remove only the stagnant water that is stored in the well casing, (above the screened interval), by slowly (to avoid mixing of the water column) bailing or pumping from the top of the water column down to a few inches below the top of the screen. (If the well keeps recharging and the water level is never lowered down below the top of the screen, skip down to High Yield Wells).

Once the water in storage is removed, samples can be collected directly from the screened portion of the well (Nielsen, 1995 & 1999). The water level may be lowered below the top of the screen after VOCs are collected.

Note: There is sometimes a fine line between very low yield wells and dry wells. If the well continuously does not yield enough water to collect a full sample within 24 hours, this well could be considered inadequate or "dry." However, this is relative, depending on the volume of sample required. This should be noted and discussed with the project manager and/or permit reviewer. Most facility permits state that if a monitoring well is consistently dry, then the well needs to be replaced. Document the beginning water level and observe the recharge capabilities of each well.

2. High Yield Wells — For high yield wells (wells in which the water level does not drop to the top of the screen while purging with a bailer), purge 3 to 5 well volumes from the well (refer to procedure C.5. for calculating a well volume). The number of well volumes to be purged is somewhat program dependant.

   Stabilization Indicator Parameters:

   Certain indicator parameters such as pH, temperature, specific conductivity, redox, and dissolved oxygen may be measured throughout the purging process to aid in determining stabilization and representativeness of the water. If using a pump to purge, USEPA (1992), recommends that purging continue until measurements of turbidity, redox potential and dissolved oxygen in in-line or downhole analyses of ground water have stabilized with approximately 10% over at least two measurements - for example, over two successive measurements made three minutes apart, if pumping at a rate of approximately 0.2 to 0.3 L/min. Nielsen, 2001, gives specific guidance on using indicator parameters to determine stabilization when conducting low flow purging. USEPA also lists many other references for this recommendation that are not listed here.

3. Water Table Wells — In some wells, the water table is always within the well screen, either by design (e.g., wells monitoring for petroleum hydrocarbons) or as a result of site hydrogeologic conditions. In these wells, yield can be variable. In this case, the well basically has no stagnant water being stored in the casing (see explanation in next paragraph). While water in the well casing (above the screen) may be chemically non-representative of formation water, recent research has concluded that the water within the screened interval of nearly all wells is indeed representative of formation water quality, provided that the well has been designed, installed, developed and maintained properly (Nielsen,

1999). In such wells, the water in the formation and that within the well screen are able to exchange freely and the well screen is continually "flushed" (Gillham et al., 1985; Robin and Gillham, 1987). Even in low hydraulic conductivity formations (clays, silty clays, clayey silts), groundwater flow is generally sufficient to maintain an exchange of water between the formation and the well screen (Nielsen, 1999).

While the water within the screened interval of the well is representative of formation water quality, the first bailer full of water removed from the well prior to sampling should be discarded. The reason being that this water has been in direct contact with the atmosphere. The air will mix in with the upper 6 inches (approximately) of water in the well (Nielsen, November 2001). Sampling may commence after the first bailer volume has been removed. The well may be purged further only if the well has sufficient recharge to ensure the water level in the well will not be lowered substantially and will definitely not be purged dry (i.e., if it is screened in course-grained sediments and length of water column is sufficient). The water level must be monitored if water is to be purged from the well and caution must be used to ensure the water level does not drop substantially prior to sampling for VOCs.

4. Wells that contain light or dense non-aqueous phase liquids (LNAPLs and DNAPLs) — Wells that contain NAPLs may or may not be purged prior to sampling, depending on the sampling objectives. They may be sampled, then purged and re-sampled. If contaminated purge water is generated, it must be managed and disposed of properly.

c. General Purging Procedures for All Monitoring Wells

1. Purge slowly from the top of the static water level, so that mixing of the water in the screened zone with the overlying stagnant zone is kept to a minimum. Successively lower the purging device further down the well to keep up with the dropping water level, stopping just below the top of the screen.

2. The rate at which wells are purged of stagnant water should be kept to a minimum and should not exceed the rate at which the well was originally developed, if this is known. This is more of a concern when purging high yield wells with a pump.

3. Frequently, facilities have dedicated bailers and line that are left in the well. It should be decided ahead of time what steps will be taken if dedicated equipment is found in the well. It is not always advisable to use this dedicated equipment, depending on its condition. Frequently, disposable bailers are left in the well and re-used by facilities. This is not

what they were intended for and they are sometimes very dirty. If these are found in the wells, do not re-use them.

4. Plastic sheeting should be placed around the well to lay equipment on. Care should be taken not to step on plastic sheeting with dirty boots. Contact between the plastic sheeting and the bailer and suspension line should be kept to a minimum.

5. Great care must be taken when setting equipment around a monitoring well. Electronic equipment is very sensitive to humidity and moisture. Some equipment, such as the pH meter, will be ruined if one drop of water lands on it in the wrong spot. Cut the plastic sheeting large enough to be able to set equipment a sufficient distance from the well so that splashing will not affect it.

6. Where dedicated equipment is not used, purging should progress from the least contaminated well to the most contaminated well, whenever possible. Sometimes return trips will be needed to collect the entire sample because recharge is so slow in certain wells. Steps to protect against cross contamination should always be practiced.

7. Deposit purge water into containers of known volume, such as 5-gallon buckets, in order to measure how much water has been purged. Record this for each well. Disposition of the purge water will be determined on a site-specific basis.

8. If using a pump or non-dedicated or non-disposable bailer, decontaminate them between wells. For decontamination guidelines refer to ASTM, 1992 and USEPA, 1992.

d. Special Considerations when Purging with Bailers

1. Always purge slowly from *the top of the static water level* when using a bailer.

2. The bailer must be lowered and pulled out as slowly as possible. It should be lowered slowly to avoid mixing of the stagnant and fresh portions of the water column, to prevent potential redevelopment and to minimize disturbance and aeration of the water column. It should be submerged only to the depth necessary for fill (during purging) and should be removed in a manner that causes as little agitation as possible.

3. A bailer or cable should never come in contact with the ground (Ohio EPA, 1995, pg. 10–17; USEPA, 1992 pg. 7–19). When lowering or retrieving the bailer, care should be taken that the cord does not touch the

ground, where it might pick up surface dust or contaminants and potentially introduce them into the well (Sanders, 1998). Using a cord and reel assembly or the "windmill" method can help prevent this. To use the windmill method, the arms should be stretched out away from the sides and the thumbs should be hooked on the cord. Now the cord should be pulled up, hooking each thumb around it alternately in turn. The wider the stretch, the more efficiently the bailer can be retrieved. Bringing it up slowly and smoothly will help avoid dislodging the check valve, spilling the sample, or volatilizing the gases within the sample (refer to page 282 of Sanders, 1998).

4. Do not "milk" the well by repeatedly and swiftly pulling the bailer up through the water column. This does not make the water enter the well any faster. It only serves to stir up sediments, yield a turbid sample, and possibly overdevelop the well.

5. Tie the suspension cord to the bailer with a very secure knot. Tie the end of the suspension line around the wrist for added protection. Refer to the discussion of "Lost Bailers" at the end of this section for retrieval procedures.

6. If it is necessary to leave the well temporarily during purging or sampling, store the bailer above the water level or above the point to which the water level is expected to rise, keeping the suspension line clean.

   To accomplish this, follow these steps:

   a. Cover the lockplate of the protective casing with a clean paper towel or latex glove. Wrap the bailer's suspension line securely around it several times, so the bailer will not fall down the well.

   b. Place the rest of the line in a plastic bag (food-grade) for protection. Tie off the top of the bag or use the ziplock feature and place it inside the protective casing.

   c. Place the lid back on the well loosely. If the well is going to be left unattended for a short while, re-lock the well.

      There are other ways to accomplish this, but the main idea is not to let the bailer sink down through the column of water and to keep the bailer and the line clean and off of the ground. If the well has no protective casing, the bailer and line may be stored in a clean 5-gallon bucket until it is used for sampling.

e. Special Considerations when Purging with Pumps

1. High Yield Wells — Slowly pump stagnant water from the top of the water column and lower the pump down as the water level drops. Only in the case in which the pump is set at the top of the water column at the start of purging, and follows the water level down during purging, could the pump remove all stagnant water from the well to prepare it for subsequent sampling with a bailer. A common mistake is placing the pump well below the top of the water column and the water level is not drawn down to the intake of the pump. Especially where the pump intake is within or just above the screen, most of the water pumped during purging will come from the formation. Much of the stagnant water column above the pump remains in the well, and is very likely the water subsequently sampled with a bailer (Nielsen, 1999).

   If the pump is placed within the screened area for purging purposes, indicator parameters should be used to determine stabilization.

   Pumping rates during purging should be kept at a minimum. This will vary depending on the type of pump used. Excessive rates may result in the introduction of groundwater from zones above or below the well screen, which could dilute or increase contaminant concentration of samples (Ohio EPA, 1995). Purging may cease when 3–5 well volumes have been removed or the water level is just below the top of the screened interval.

2. Low Yield Wells (wells that would go dry during pumping, if allowed) — Placement of the pump intake near the top of the screen for purging is adequate, if *all* of the stagnant water is removed above the pump. Otherwise, pump the stagnant water from the top of the water column and lower the pump down as the water level drops, as was described under No. 1 "High Yield Wells".

3. Low Flow Purging Technique: Studies have indicated that low rate/low volume purging and low rate sampling (pumping rates are commonly less than 1 L/minute) at the screened interval using dedicated bladder or electrical submersible pumps is a viable alternative to traditional purging methods (e.g., 3–5 well volumes) and may produce more representative samples. The pump must be appropriate for the constituents to be analyzed because the pump must also be used for sampling because the pump must be dedicated to the well. Bladder pumps are suitable if sampling for VOCs. Bailers and non-dedicated pumping equipment can not be used with this technique because they pass through the stagnant

water column, causing mixing. Low flow purging and sampling may offer advantages in deep wells equipped with dedicated pumps, that would yield large amounts of purge water under traditional purging methods. For more information on the low flow purging and sampling technique, refer to Nielsen, 2001 and Nielsen, 2002; USEPA, 1992, pg. 7–8; Kearl, et al., 1994; FERMCO, 1993; Barcelona, et al, 1994; Robin and Gillham, 1987; Puls and Powell, 1992 & 1993.

4. LNAPLs & DNAPLs — Some pumps are not made to pump extremely contaminated water (example: gas or diesel) and doing so could shorten the life of the pump. Check the manufacturers specifications regarding this and other operating procedures. Some pumps are difficult to decontaminate after exposure to high levels of contaminants.

5. Always shut off the pump immediately when it is drawing air.

6. Follow the manufacturers instructions regarding operation of any control mechanisms. Decontaminate any non-disposable, non-dedicated pump equipment between wells. Refer to ASTM, 1992, and USEPA, 1992.

VOCs samples should be collected within about 4 hours after purging is completed and the entire sample should be collected as soon as possible and within 24 hours after purging (refer to C.7.h., VOC Sampling, for more information).

7. Sample Collection

a. Selection of Sampling Devices

Bailers or pumps designed for groundwater sampling may be used for sampling. This document does not dictate what type of sampling device to use. There is no one perfect sampling device for all parameters. The equipment must be appropriate for the constituents being sampled. All devices will alter the sample to some degree. Just the mere process of bringing the water to the surface changes the water chemistry. The decision as to what type of sampling device to use must be made by the project manager, including whether to use IEPA equipment or equipment supplied by the facility. This decision is dependent on the data quality objectives set for the project, the quality/cleanliness of the facility's equipment and the owner/operator's degree of cooperation. Some references that discuss advantages and disadvantages of sampling with various types of pumps and bailers include: Ohio EPA, 1985; Nielsen, 1991; USEPA, 1992; Barcelona, et al, 1985b; ASTM Standard D4448.

Keep in mind the following, summarized from the Nielsen Environmental Field School Course (1995):

1. Some pumps are not appropriate for sampling for volatile organic compounds. Beware of manufacturers that advertise "USEPA-approved" for VOC sampling. The pump might not be reliable at all for sampling VOCs. There are no pumps that are officially "approved" for sampling VOCs, because there is no official approval process. Some pumps are less suitable or reliable than others and the above-referenced documents give some general recommendations regarding suitability. For example, some electrical submersible pumps draw the water in with a negative pressure then push it (positive pressure) through the impellers at rates up to 23,000 RPM (110 MPH). Peristaltic, surface centrifugal, and vacuum pumps operate by imparting a pressure lower than atmospheric pressure (i.e., suction and vacuum) to lift water to the surface through the tubing; this can volatilize the sample. The centrifugal electric submersible pump depends on water moving over the motor to cool it, thus adding heat to the sample, which can cause volatilization. Increased pressure and temperature changes should be kept to a minimum because they cause degassing, stripping of VOCs and alteration of pH (which can change dissolved metal concentrations). The rate of flow must be considered also.

Positive displacement pumps (except air-lift) such as bladder pumps are generally suitable for VOC sampling. With proper flow rates, gear-drive pumps and some electrical submersible pumps may also be considered reliable for VOC sampling. If you want to use a pump for VOC sampling (and there are many different types on the market), thoroughly research it first. In some cases, the type of pump to be used is somewhat dictated by the diameter of the well (such as 1 inch piezometers or hydraulically driven wells).

2. The most effective and efficient use of a sampling pump is to dedicate it to a well. Since the IEPA inspector will not usually be using dedicated sampling pumps, he/she will have to thoroughly decontaminate the pump between wells to reduce the risk of cross contamination and provide for quality control samples to determine effectiveness of the cleaning procedures. USEPA, (1992), and ASTM D5088 (available from IEPA library) provide decontamination procedures. Some pumps are difficult to take apart and clean in the field and large amounts of decontamination water will have to be hauled to the site.

b. General Sampling Procedures for All Monitoring Wells

1. The monitoring well shall be sampled as soon as possible after purging is complete. VOC samples may be collected immediately or within about 2 to 4 hours of purging. (Refer to C.7.h., VOC sampling, for more information regarding this time restriction). If there is insufficient volume to collect the rest of the samples, they should be collected as soon as possible and no longer than 24 hours after purging is completed. For turbid wells, after organic samples are collected, the well may be allowed to set for several hours to allow the sediments to settle before obtaining a total metals sample or to allow for recharge.

2. If the water level is above the top of the screen after purging, the bailer or pump intake should be lowered to within the screened interval to collect the sample. The water level may be allowed to drop below the top of the screen after volatile organic samples are collected because the inorganic parameters are less subject to volatilization effects.

3. Samples should not be transferred from one sample container to another as this may result in losses of constituents onto the walls of the container or sample aeration, except samples that need to be collected in a transfer vessel for field filtering.

4. Where non-dedicated, non-disposable sampling equipment in used, sampling should proceed from the least contaminated well to the most contaminated well. If this is unknown, sample the upgradient wells first.

5. Plastic sheeting should be spread on the ground near the well, if this hasn't already been done, unless impractical.

6. Clean, chemical-resistant protective gloves will be worn by each person in the sampling team who will be in direct contact with purging/sampling equipment. Each member of the team involved in sampling the well will wear clean protective gloves for each well.

7. Sampling should not be conducted in the rain unless some type of cover is provided which prohibits the precipitation from entering the well, bailer, and sample bottles. Suggestions: a large umbrella, or clean Visqueen or tarp stretched overhead at the sampling area.

8. Attachments 1 and 2 are optional forms that may be useful in the field for recording sampling information. These are examples of how information could be recorded, either on the form or in a field logbook.

9. For newly installed monitoring wells: As a rule of thumb, a minimum of two weeks should be allowed to pass between installation or well development and sampling a newly installed well. This allows some time for the well to equilibrate hydraulically and chemically and to recover from well installation trauma (caused by substances introduced during well installation, such as drilling fluids, seals, and backfills). The actual waiting time could be several months in fine-grained formations and days to weeks in coarse-grained formations, depending on groundwater velocity (Nielsen, 1995; Puls and Powell, 1992; Nielsen et al. 1991, pp.456–461).

c. Sampling light or dense non-aqueous phase liquids (LNAPLs or DNAPLs)

1. The approach to collecting light phase LNAPLs is dependent on the depth to the surface of the floating layer and the thickness of that layer (determined with an interface probe). If the thickness of this phase is 2 feet or greater, a bottom valve bailer may be used. The bailer should be lowered slowly until contact is made with the

surface of the LNAPL, and lowered to a depth less than that of the immiscible/water interface depth.

When the thickness of the floating layer is less than 2 feet, but the depth to the surface of the floating layer is less than 25 feet, a peristaltic pump can be used to collect a sample.

When the thickness of the floating layer is less than 2 feet and the depth to the surface of the floating layer is beyond the effective reach of a peristaltic pump, a bailer must be modified to allow filling only from the top. If an LNAPL is to be sampled, lower the sampling device down to the top of the layer and collect the sample (USEPA, 1986)

2. If a DNAPL is to be sampled, it must be collected prior to purging the well. A double check valve bailer may be used to collect a DNAPL sample. The key to sample collection is controlled, slow lowering and raising of the bailer to the bottom of the well. An alternative procedure would be to use a peristaltic pump with disposable tubing that is lowered very slowly down to the immiscible layer. The pump should be operated very slowly to inhibit volatilization as much as possible and to reduce agitating the DNAPL layer. After the dissolved sample is collected, lower the tubing to the bottom of the well and collect the DNAPL layer (USEPA, 1986

d. Sampling with Bailers

1. If the well is a particularly muddy, turbid one, and the bailer is visibly contaminated after purging the well, use a new bailer for sampling.

2. The bailer must be lowered <u>slowly</u> into the screened area to collect the sample without letting it touch the bottom of the well. The bailer should never be dropped into the well, as this will cause degassing of the water upon impact (USEPA, 1992). Fines resting on the bottom of the well will be stirred up and mobilized if the bailer touches the bottom and the water column will be disturbed.

3. Groundwater should be poured directly from the bailer into the sample bottles, unless the sample is to be filtered. Samples to be filtered may be collected in a transfer vessel (clean, unpreserved lab bottle).

4. Bailers are not to be reused from well to well unless they are properly decontaminated. If disposable bailers are used, a new bailer is to be used for each well.

5. New chemically resistant cord, such as nylon or polypropylene, will be used for each well. Teflon-coated stainless steel cable must be thoroughly decontaminated before re-using. It is common at industries that have many monitoring wells to dedicate nylon cord or steel cable with a bailer. It is recommended not to use the facility's equipment if it is visibly contaminated.

e. Sampling with Pumps

If samples are being collected with a pump, remember the following factors:

1. Some pumps are not made to pump extremely contaminated water (example: gas or diesel) and doing so could shorten the life of the pump. Check the manufacturer's specifications regarding this.

2. For high or low yield wells, place the pump intake at or just above the well screen for sampling.

3. The flow rate should not exceed approximately 100 ml/min to avoid agitation and reduce the loss of volatiles (Barcelona et al, 1985; USEPA, 1992) and so that the water is flowing from the screened area into the sampling device. Low flow purging techniques should be utilized.

4. Follow the manufacturer's instructions regarding operation of any control mechanisms.

5. The pump must be appropriate for the sampling objectives and data quality objectives.

6. The pump must be properly decontaminated between sampling each monitoring well.

f. Handling Sample Bottles

1. Protective gloves should be worn when removing lids from preserved sample bottles.

2. No sample bottles or clean sampling equipment will be placed directly on the ground.

3. Lids are to be kept on the sample bottles at all times except during filling. It is preferable to hold the lid inside down while filling the bottle, instead of actually setting it down. Nothing is to touch the inside of the bottle/lid except groundwater.

4. Bottles with preservatives in them cannot be overfilled or rinsed.

5. Don't let the bottles sit in the sun after they are filled. During the warm season, as soon as possible, "supercool" the filled bottles by placing them directly on crushed or cubed ice. To reduce the chance of cross contamination, place the bottles in food-grade plastic bags before setting them on the ice. When they have been chilled they should be placed in their appropriate coolers with double-bagged cubed ice, ice blocks, blue ice or dry ice. Be careful when using dry ice, as it can freeze the samples as well as burn you. Be aware that methylene chloride has been detected in some blue ice. Reduce exposure of bottles to the blue ice by bagging the blue ice, bagging the sample bottles with food-grade plastic bags. It is highly suggested to always place the VOC vials in food-grade ziplock baggies to protect them from any potential source of contamination. The use of blue ice is discouraged, as it is a potential source of contamination.

6. If you choose to double-bag the ice, remember that ziplock baggies will leak. Place the ice in a ziplock baggie and place that in a tie-off baggie to prevent leakage. Coolers that contain samples must be filled with new ice daily during warm weather, if samples are not delivered on the same day they were collected.

7. A photo should be taken of the sealed sample next to the well.

g. Order of Sample Collection

1. Samples should be collected and containerized in order of volatilization sensitivity of the parameters, with VOC bottles filled first.

   The complete order for filling samples bottles is as follows:

   1. VOCs
   2. Total Metals*

3. Semi-Volatiles
4. Phenols
5. Cyanide
6. Unpreserved & Unfiltered Parameters
7. Total Nutrients
8. Dissolved Parameters (Inorganics to be field filtered)
9. Collect Field Measurements (Ph, conductance, temperature)

*Collection of Total Metals: These may be collected after VOCs if the well water is clear. If after taking all the precautions during purging to avoid agitation of the groundwater, the water still becomes visibly turbid, the following steps may be taken to reduce turbidity of the total metals sample.

a. The well may be allowed (after collection of VOCs and SVOCs), to set for several hours to allow fines to settle in the well and reduce turbidity prior to collection of the total metals sample; OR,

b. Collect the Total Metals sample in an unpreserved ½ gallon plastic sample bottle. The Total Metals sample may be allowed to set for several hours (in a cooler on ice or in a refrigerator) to allow the fines to settle out. The sample is then slowly decanted into a properly preserved bottle to be turned in for analysis.

h. Volatile Organic Sampling

1. There are studies with differing conclusions as to the optimal time to collect VOC samples. Herzog et al. (1988) concluded that the common practice of next day (within 24 hours) sampling for low yield, slow recovery wells is adequate. This study also concluded that VOCs collected 4 hours after purging may yield a higher concentration than those collected earlier or later, but this difference was not statistically significant in that study (ISGS, 1991). Title 35 IAC Part 620 incorporates by reference Barcelona, 1985b, which states: "The recovered water should not be allowed to remain in the well casing for more than about two hours prior to collection or it is likely to be chemically altered for several parameters."

   For purposes of IEPA sampling, the monitoring well shall be sampled as soon as possible after purging is complete. VOC

samples may be collected immediately or within about 4 hours of purging.

2. All VOC vials and VOC blanks must be kept in the same cooler for each day of the sampling.

3. The sample will be taken directly from the sampling device. Use of an interim container or transfer bottle is not acceptable.

4. When sampling for VOCs, collection, handling, and containerization must not take place near a running motor or any type of exhaust system (Ohio EPA, 1995). If a motor must be turned on during sampling, position it so that samples are collected upwind from the exhaust. In this circumstance, collection of a field air blank is advisable (see section 1.b.6.B.).

5. Do not write on the VOC vial with permanent markers. Markers may contain solvents that could penetrate the Teflon septum and contaminate the sample. Instead, use a ball-point pen or "China" marker.

6. To collect the VOC sample, tilt the 40-ml glass vial and fill it such that the water flows very slowly down the inside of the bottle. When the bottle is nearly filled, upright the bottle and continue filling until a convex meniscus is formed. Care must be taken not to overfill the VOC vial, since it is a preserved bottle.

7. No headspace must remain in a VOC bottle after it is capped with its fluorocarbon-lined cap. Bubbles act as miniature air strippers and could alter the VOC concentration in the sample (USEPA, 1992, pg. 7–24; Nielsen, 1995; Ohio EPA, 1995). To check for air bubbles, turn the bottle upside down and tap it gently on your palm. If any bubbles are present, the sample and bottle should be discarded and the samples recollected with a new preserved bottle. The vial should not be "topped off" to fill the additional head space.

8. Tighten the VOC cap securely. Do not over tighten the lid as the bottle or cap could break or a leak could be formed.

9. One set (2 bottles) of VOC trip blanks will accompany the sample bottles in the field and to the lab for each day of sampling and for every set of 10 VOC samples (see section B.1.b.4.). Unless only one set of trip blanks are being submitted to the lab at a time, the blanks shall be labeled as to the date they were used.

10. VOC vials must be placed into food-grade plastic bags before placement into a cooler with blue ice.

11. The use of bottom emptying devices is left to the project manager's discretion. Bottom emptying devices are tubes or attachments that come with the bailers or can be purchased and attached to the bottom of the bailer to control flow. Due to the formation of air bubbles that travel up through the bailer, the sample could be stripped of some volatile constituents. According to Nielsen (1995),-the preferred method is to pour the sample slowly from the top of the bailer The ASTM D4448-85 procedures recommend that the sample for VOCs be collected from the bottom of the bailer with an emptying device because this water has not been exposed to the atmosphere. Bottom emptying devices that come with the disposable polyethylene bailers are not recommended for use because the flow rate cannot be controlled.

i. Split Samples

1. If the owner/operator or their consultant collects a groundwater sample at the same time the IEPA is sampling the monitoring wells, the resulting sample is called a split sample. The details of this type of sampling must be worked out prior to the field visit. Things to be considered are:

    a. IEPA is not obligated to provide the owner/operator with sample bottles.

    b. IEPA will not provide lab services for the owner/operator's portion of the split sample.

    c. Transfer vessels will not be used to composite the sample. VOC vials should all be filled from the same bailer. If this cannot be accomplished, alternately fill the IEPA and the owner/operator bottles. For the rest of the bottles, fill the containers alternately until both are filled or split each bailer volume into two portions, one for the IEPA's bottle and one for the owner/operator's bottle, until the bottles are filled.

    d. If the well is low yield, a true split sample may be impossible to obtain. If there is a possibility of inadequate volume of groundwater and if the IEPA initiated and is conducting the sampling, IEPA bottles will be filled first. If

the owner/operator or the consultants are conducting their routine quarterly or semi-annual sampling, the owner/operator's bottles will be filled first.

8. Field Filtering

a. General Considerations

1. Metals samples may be field filtered. The decision whether or not to filter should will be determined by the project manager prior to the sampling event. Filter size is dictated by the program (i.e., 0.45 or 5 micron).

2. Groundwater samples below 5 Nephelometric Turbidity Units (NTU) should not be filtered (Ohio EPA, 1995, pg. 10–21; Puls and Powell, 1992; USEPA, June 1992). If the water exceeds 5 NTUs in turbidity, subsurface geology should be considered. Field filtration should not be necessary when sampling from karst; bedrock with open, interconnected fractures; clean, highly porous gravel-to-boulder sized deposits; and any other formation characterized by a high degree of particle mobility (Ohio EPA, 1995).

3. Samples for dissolved inorganic analysis (metals, chlorides, etc.) should be filtered as soon as possible.

4. Filtering shall take place in a shaded area if possible. Avoid setting filled bottles in direct sunlight.

b. Filtering with a Peristaltic Pump

Filtering may be conducted with a peristaltic pump and silicone tubing as follows:

1. Attach a 0.45 or 5 micron (μm) disposable in-line filter cartridge to the tubing. Filter size is dictated by the sampling program, (e.g., RCRA or CERCLA, etc.). If the 5 micron cartridge is used, an adapter is necessary to attach it to the tubing. Note that the flow direction is indicated by an arrow embossed on the side of the cartridge.

2. The cartridge must be pre-conditioned by flushing it with 8 to 16 oz. of groundwater to remove potential residues from the

manufacturing process and to eliminate channel flow through the filter.

3. If filtering the following groundwater samples, filter them into their appropriate pre-labeled bottles in the following order:

   —Metals
   —Nutrients
   —Others: Chloride, fluoride, sulfates, alkalinity

4. Place the filled bottles into a cooler with ice or blue ice as soon as they are collected and/or after they are photographed.

5. Discard the used filter cartridge and use a new one for each different monitoring well sample.

6. It is recommended that the tubing be changed after every 5 samples, and properly decontaminated between each sample. The tubing may be changed more often and even changed between each sample if desired. If the tubing is decontaminated, an equipment blank may is recommended that an equipment blank be collected after the fourth decontamination. The tubing must be changed between facilities. Decontaminate the tubing by flushing it with a Liquinox/water mixture, a dilute acid/water mixture, followed by a deionized water flush. Always flush with a portion of the groundwater before filtering each groundwater sample.

c. Filtering with "Quickfilter" Transfer Vessel and hand pump

1. Fill the properly decontaminated transfer vessel with unfiltered groundwater.

2. Screw on lid, making sure O-ring is secure.

3. Thread a 0.45 or 5 micron (μm) disposable in-line filter cartridge to the discharge tube of the lid. Filter size is dictated by the sampling program (e.g., RCRA, RPMS, etc.)

4. Attach the tubing to the intake on the transfer vessel lid and to the hand pump.

5. Pressurize the transfer vessel. If the vessel does not pressure up, unscrew the lid and ensure the O-ring has seated properly. Screw the lid on and pressurize again.

6. The cartridge must be pre-conditioned to remove potential residues from the manufacturing process and to eliminate channel flow through the filter. Allow approximately 8 to 16 oz. of groundwater to flow through the disposable filter prior to filling the sample bottles.

7. Properly decontaminate the transfer vessel. Acetone may NOT be used. The vessel may be de-pressurized by attaching the tubing to the other end of the handpump (end that points away from user, see Attachment 4). This allows the user to open the transfer vessel for decontamination. Decontamination procedures include:

—Wash the vessel and lid with a Liquinox/water mixture
—Rinse with distilled water or distilled/deionized water (Nanopure)
—Dry the vessel with a paper towel. Dry the inside of the tube leading into the lid as well as possible.

Place the filled bottles into a cooler with ice or blue ice as soon as they are collected and/or after they are photographed. Samples must be within +/- 2 ^{o} of the target temperature of 4^{o}C upon delivery to the lab. Blue ice does not accomplish this in warmer weather. Blue ice also may contain methylene chloride and should never come into direct contact with the VOC bottles. Wet ice or dry ice is preferred.

9. Lost Bailers

a. If a bailer is lost down a well, a fishing kit consisting of heavy fishing line, large treble hooks, and weights (preferably stainless steel), should be used to "fish" it out. Such a kit should be included as standard equipment so time is not wasted going to a store to buy the necessary gear.

b. Attach the hook and weight to the line and lower the line into the well to the approximate depth of the bailer. Work it up and down until you have caught the bailer.

c. Lightweight polyethylene and Teflon bailers are easily fished out of a shallow well, unless they are stuck. It is much more difficult to fish out a heavy stainless steel bailer or a bailer in a deep well.

d. Dropping the bailer allows it to sink to the bottom of the well, stirring sediments and increasing the turbidity of the sample. Precautions should be taken to avoid losing a bailer. Tie very secure knots when attaching the nylon cord to the bailer and tie the other end to your wrist while using the bailer.

e. If a bailer consistently gets "hung up" on the inner casing of the well, it can get lodged (possibly permanently) or the bailer line can break. If this situation occurs, switching to a smaller diameter bailer or different purging/sampling device is advisable.

10. Documentation of the Sampling Event ✍

The information listed below should be logged in the field for each day of the sampling event. Attachments 1, and 2 are optional forms that may be useful in the field to help document some of this information.

1. A chronological listing of significant site events and sampling team activities.

2. Air temperature, wind direction, recent rainfall, and presence of ponded water.

3. Names of sampling team members, facility representatives and officials.

4. Results of each monitoring well inspection (i.e.: was well locked?) degradation of casing; ponded water around well; evidence of heaving or subsidence; vented caps and drain hole present?). Refer to Attachment 1 for a monitoring well inspection checklist.

5. Identification number of each monitoring well.

6. Direct reading instrument measurements around wellhead.

7. Diameter of well and purge volume calculations.

8. Static water level and total depth of well measurements. Note if siltation has occurred.

9. Well purging procedure and type of equipment used, date and time. Name of person who purged well.

10. Purge volume and pumping rate.

11. Measurements of pH, specific conductance, and temperature during purging activities, equipment used to collect these measurements, and calibration procedures for this equipment.

12. Physical characteristics of the groundwater as it is being purged and sampled (color, odor, turbidity).

13. Well recharge rate: fast, slow, dry, etc.

14. Sample withdrawal procedure and equipment used, date and time of sampling, names of samplers.

15. Types and numbers of sample containers and preservatives used (not necessary to log in the field if this information was included in a sampling and analysis plan).

16. Time of filtering/preservation of filtered samples, equipment/procedure used to filter them, and which parameters were filtered.

17. Parameters requested for analyses.

18. Sample transportation and delivery procedures.

19. Photographs of the sample and the sample location and the direction and time the photo was taken.

20. Any deviations from the original sampling and analysis plan.

The above information will be compiled and transferred to the appropriate forms (e.g., Chain of Custody Form) and will be included in the final written sampling inspection report.

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E. ATTACHMENTS

1. Monitoring Well Inspection Checklist.

2. IEPA Monitoring Well Sampling Inspection Form.

ATTACHMENT 1: IEPA/BOL MONITORING WELL INSPECTION FORM

LPC#_____ County _____

City/Site Name_____

If any problem is observed, describe in the comment section and take a photo.

Well/ Piezometer	Lock in Place Y/N	Well Clearly Labeled Y/N	Survey Mark Present Y/N	Cap Vent Y/N	Standing or Ponded Water Y/N	Drain Hole Y/N	Evidence of Collision Damage	See Permit & 620.505(a)(5)(D)(iii) Surface Seal Integrity	See Permit & 620.505(a)(5)(D)(iii) Evidence of Casing Deterioration or lack of physical integrity? (Dents, brittle, stained, loose?) Inner	Outer	Comments	Photo #

IEPA/BOL/DLPC/FOS Groundwater Sampling Inspection Field Readings

– County **Well #:**
/ Total Depth below TOC:
Groundwater File Depth To Screen:

Approaching the Well

Date _____ Inspectors _____ Weather _____
PID/FID Response _____ CGI Response _____ Geiger Response _____

Other _____ (including speed of response)

Inspecting the Well

Date _____ Inspectors _____ Weather _____
(Complete IEPA/BOL Monitoring Well Inspection Form)

Well Measurements

Date _____ Inspectors _____ Weather _____
1. Depth to water from MP _____
2. Total Depth from MP _____
3. Stick-up Height _____
4. MP elevation, MSL _____
5. GW Elevation (#4 – #1) _____

Purging Information

Date _____ Inspectors _____ Weather _____
6. Linear Feet of water in well _____ (#2 – #1)
7. Gallons of Water in Well _____ (#6 X 0.163 for a 2" Casing)
8. Max Gal. of water to purge _____ (#7 X 3 to #7 X 5)
9. Gallons purged _____ Purged with ☐ Pump (rate _____) ☐ Bailer
10. Time purged _____ – _____

Sampling Information

Date _____ Inspectors _____ Weather _____
Well Sampled with: ☐Bailer (type _____)
☐Pump (type _____) Rate _____

Sample Time (Beginning–Ending)	Filter Time	Seal Date	Seal Time	Photo Number(s)
–				

Field Readings (if applicable)		
Temperature	Conductance	pH

Miscellaneous Notes: _____

Conversion Factors

Diameter of Casing or Hole (Inches)	Conversion Factor (Gallons per Foot)
1	0.041
1.5	0.092
2	**0.163***
2.5	0.255
3	0.367
3.5	0.500
4	0.653
4.5	0.826
5	1.020
5.5	1.234
6	1.469
7	2.000
8	2.611
9	3.305
10	4.080
11	4.937
12	5.875
14	8.000
16	10.44
18	13.22
20	16.32
22	19.75
24	23.5
26	27.58
28	32.00
30	36.72
32	41.78
34	47.16
36	52.88

Linear Feet of Water Column	Volume of Water (Gallons)
0.5'	0.08
1.0'	0.163
1.5'	0.245
2.0'	0.326
2.5'	0.408
3.0'	0.489
3.5'	0.571
4.0'	0.652
4.5'	0.734
5.0'	0.815
5.5'	0.897
6.0'	0.978
6.13'**	**1.0**
6.5'	1.06
7.0'	1.14
7.5'	1.22
8.0'	1.30
8.5'	1.39
9.0'	1.47
9.5'	1.55'
10.0'	1.63
10.5'	1.71
11.0'	1.79
11.5'	1.87
12.0'	1.96
12.5'	2.04
13.0'	2.12
13.5'	2.20
14.0'	2.28

SECTION VIII: PRIVATE DRINKING WATER WELL SAMPLING

TABLE OF CONTENTS

SECTION VIII: PRIVATE DRINKING WATER WELL SAMPLING

A. REMINDER CHECKLIST

1. Pre--Sampling Activities

___ Assess site hazards, and develop and/or review a safety plan.

___ Develop and/or review sampling plan.

___ Establish purpose(s) of sampling.

___ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.

___ Bring enough clean water for rinsing, cleaning, and cooling off.

___ Schedule lab time and order your bottles two weeks in advance. Be sure to inform the laboratory and bottle preparation staff that your order includes drinking water samples.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.

___ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept.).

___ Identify private water well users. Obtain required access agreements. Schedule convenient time to sample well.

___ Prepare your sample containers prior to sampling (label and organize).

2. During Sampling Activities

Note: When sampling potable water supplies, utmost care must be taken to insure that samples are representative of the water supply being sampled. This is important not only from a technical and public health perspective, but also from a community relations standpoint. Poor sampling techniques may result in incorrect results (either not detecting a compound which is present or by contaminating the sample and falsely indicating a compound which is not present). If incorrect results are disclosed to the public, it may be impossible to change public opinion when correct results are reported.

Several rules of common sense can make a difference when speaking to citizens and will help avoid additional work in the future. It is important to inform the homeowner of ongoing sampling activities and procedures, to eliminate any confusion they might have, and to answer questions as accurately as possible. When sampling residential wells, you are representing the Agency. To earn credibility, you must provide the best possible assistance to the resident and maintain a professional attitude at all times.

When communicating with citizens...

* be honest; admit when you do not know an answer to a question;

* keep explanations simple but not condescending or patronizing;

* speak in a volume appropriate to the situation - oftentimes older persons may be hard of hearing;

* do not make promises you cannot or will not keep. Follow through if you promise to provide them with additional information, answers or assistance;

* maintain control and do not lose your temper despite irritating confrontations; remain calm and do not use foul or offensive language;

* wear attire that is appropriate for the situation: and

* clean up any mess caused from sampling, i.e. water paper towels and disposable gloves.

___ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

___ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.

___ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.

___ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.

___ Never composite VOC samples.

___ Wipe off outside of sample bottles prior to placement in cooler.

___ Measure pH, specific conductance, and water temperature.

___ Follow proper procedures to ensure sample is representative of groundwater.

___ Purge well prior to taking sample.

___ Follow proper procedures to avoid air bubbles or contamination of samples.

___ Have homeowner complete IEPA Private Well Sample Collection Form.

3. Post-Sampling Activities

___ Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e,. IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.

___ Keep samples cool; ship or drop off to appropriate laboratory.

___ Separate incompatible wastes so that they are not transported in the same cooler.

___ Seal odorous wastes in a cooler to avoid breathing vapors or odors during transportation.

___ Clean up any mess you may have made; homeowners will notice.

___ If the homeowner is present, indicate when laboratory results will be back. Inform him/her IDPH will contact them with results.

___ After receiving results, make sure that IDPH follows up with a phone call or letter explaining results to citizens.

B. EQUIPMENT

See equipment checklist below.

SAMPLING EQUIPMENT CHECKLIST

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book

PROJECT MANAGER:

_____Field Logbook
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera
_____Pencils & Pens
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves_____L_____XL
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water

GENERAL SAMPLING EQUIPMENT:

_____Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
1/2-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____pH/Temp/Millivolt Meter
    _____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Field Chairs
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape

C. PROCEDURES

Even though the same care and techniques used in other media sampling (i.e., ensuring that all field equipment is available and in good working order, confirming that sample coolers contain sufficient ice or cool packs to chill all anticipated samples to less than four (4) degrees Centigrade for at least twelve hours, completing chain-of-custody forms, etc.) are used when sampling private water wells, there are certain additional special procedures which shall be used.

1. Primary groundwater parameters for drinking water samples measured in the field, in addition to the specific parameters ordered for laboratory analysis, include pH, specific conductance, and water temperature.

    a. Begin with a clean, well-functioning instrument, and calibrate each day for accuracy by measuring known standards. Follow the instructions provided with the equipment to ensure proper calibration.

    b. Avoid dehydration of sensors, extreme temperatures, and excessive vibration when transporting the instrument to the field. All of these factors can affect the sensitivity of the equipment and damage various parts of the system.

2. To ensure that the water sample is representative of the groundwater, you must avoid altering the sample with outside sources of contamination.

    a. Ask if the owner obtains water from any other sources, i.e. whether water is hauled in.

    b. Wear latex gloves without talc. Latex gloves are also worn to avoid burning your hands with the HCL preservative contained in the vial when filling VOC bottles.

Note: Oftentimes the homeowner will wonder if his/her drinking water is so badly contaminated that we must protect our hands while collecting the sample. Reassure the person that the gloves are used to ensure that the sample collected is not being contaminated by us or to avoid acid burns from the preservatives.

    c. Collect the sample at a point prior to introduction into a water heater, holding tank, cistern, water softener/conditioner, or home filtering system.

    d. Protect the sampling tap from exterior contamination associated with being too close to the sink bottom or to the ground. Contaminated water or soil from the faucet exterior may enter the bottle during the collecting procedure since it is difficult to place a bottle under a low tap without grazing the neck interior against the outside faucet surface.

e. Avoid leaking taps that allow water to flow out from around the stem of the valve handle and down the outside of the faucet, or taps in which water tends to run up on the outside of the lip.

f. Remove any aerator and/or water hose from the tap prior to sample collecting.

3. To obtain a representative sample from private wells, the wells must be purged before the sample is collected.

a. Open the cold water tap to allow for a smooth flow at a moderate pressure. The rate of flow can be measured easily by placing a one-gallon calibrated bucket under the tap and measuring the time required to fill the bucket. The tap must be allowed to run until the temperature, pH, and specific conductivity readings become stabilized to ensure water standing in the well or holding tank is removed.

Often the homeowner will request that you not waste his/her water while purging the well. Therefore, you may want to use this running water on a garden or flower bed. However, those must be removed prior to collecting the sample.

b. Measure the temperature, pH, and specific conductivity at the initial purging, after ten minutes of purging, and again immediately prior to the sample collection.

c. Record unusual physical characteristics, color, odor or turbidity in the groundwater in the field notes.

d. Do not place the bottle cap on the ground or in a pocket regardless of the type of sample bottle being used.

e. Hold the bottle in one hand and the cap in the other, using care not to touch the inside of the cap.

f. Avoid contaminating the sample bottle with fingers or permitting the faucet to touch the inside of the bottle.

g. Take care when filling any container so splashing drops of water from the ground or sink do not enter into either the bottle or cap.

h. Do not adjust the stream flow while sampling to avoid dislodging particles in the pipe or valve.

4. When collecting drinking water samples for volatile organic chemicals, contract laboratories require that the pH of the sample be lowered by the addition of three drops of 1:1 hydrochloric acid (HCL) to each bottle. Vials obtained from the Bottle Distribution Center already contain the prescribed amount of HCL. Take special care when handling the HCL; wear disposable gloves to avoid burning your hands.

   a. Carefully fill the vial to slightly above the rim but not enough to allow the sample to overflow. Overflowing the bottle will result in loss of the preservative.

   b. Exercise care not to lose the Teflon liner.

   c. Do not rinse the vial, nor excessively overfill it. There should be a convex meniscus on the top of the vial.

   d. Check that the cap has not been contaminated.

   e. Place the sample vial on a level surface.

   f. Position the Teflon side of the septum seal directly over top and upon the convex sample meniscus. For the best results, lower the cap on to the sample - do not place it on the sample sideways; placing the cap on sideways will knock off the meniscus and result in air bubbles in the sample.

   g. Screw the cap down firmly - do not over tighten and break the cap.

   h. Invert the vial and tap gently on the palm of your hand. A successful seal is one in which no air bubbles are present in the sample.

(When collecting drinking water samples for volatile organic contaminants, contract laboratories require five 40 ml vials of water sample. Agency laboratory requires two 40 ml vials)

   i. Pre-label sample bottles appropriately. (Avoid opening permanent or magic marker around open sample vial.)

   j. Wipe off the sample container with paper towel.

   k. Wrap each vial with plastic bubble wrap.

l. Place each set of five into plastic Zip-loc bags and seal baggie with evidence tape.

m. Place into coolers, ensuring four (4) degrees centigrade is maintained surrounding the samples. Do not place vials directly on ice to avoid breaking of bottles.

If air is trapped in the bottle:

- Open the vial and add a few additional drops of water and reseal the bottle as indicted above. If bubbles persist, pour out, obtain a new sample bottle, and repeat entire process.

D. REFERENCES

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SECTION IX: SURFACE WATER

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SECTION IX: SURFACE WATER

A. REMINDER CHECKLISTS

1. Pre-Sampling Activities

___ Assess site hazards and develop and/or review a safety plan.

___ Develop and/or review a sampling plan.

___ Establish purpose(s) of sampling.

___ Obtain necessary sampling and monitoring equipment; decontaminate or preclean the equipment, and ensure that it is in working order.

___ Bring enough clean water for rinsing, cleaning, and cooling off.

___ Schedule lab time and order your bottles 2 weeks in advance.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.

___ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept.).

___ Become familiar with the impoundment, such as where the waste enters the unit, where the waste exits the unit (if applicable), and accessibility to the unit.

___ If sludge samples are required, refer to Section X of this document for additional guidance.

___ Prepare your sample containers prior to sampling (label and organize).

2. During Sampling Activities

___ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

___ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.

___ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.

___ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.

___ Never composite VOC samples.

___ Wipe off outside of sample bottles prior to placement in cooler.

___ Sample bottles with preservatives cannot be overfilled (liquid samples).

___ Photograph sample containers at sample location.

3. Post-Sampling Activities

___ Decontaminate all field equipment and PPE, if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.

___ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with BOL SOP for Sampling Packaging and Shipping.

___ Separate incompatible wastes so that they are not transported in the same cooler.

___ Seal odorous wastes in the cooler to avoid breathing vapors or odors during transportation.

___ Make sure water reactive wastes are not transported with water or ice.

B. EQUIPMENT CHECKLIST

The selection of the sampling devices should be based upon waste properties (e.g., liquid or solid), site factors (e.g., waste accessibility, waste generation practices, and degree of hazard), and the analytes to be quantitated (e.g., VOCs or heavy metals). Ease of use under the site conditions and the degree of hazard associated with using a given device should also be considered. Refer to the following table to determine equipment needs.

SAMPLING EQUIPMENT CHECKLIST: SURFACE WATER

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book

PROJECT MANAGER:

_____Field Logbook
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera
_____Camera Battery
_____Pencils & Pens
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves_____L_____XL
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water

GENERAL SAMPLING EQUIPMENT:

_____Sample Bottles
_____Clean Glass Tubes
_____Extra Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
1/2-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____TVA
_____pH/Temp/Millivolt Meter
_____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Field Chairs
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape

SPECIFIC SAMPLING EQUIPMENT:

_____Disposable Dippers

C. PROCEDURES

Make sure appropriate protective gear is worn and all necessary safety precautions are taken prior to collecting samples.

1. Liquid Sampling

Most surface water samples are grab samples and are collected by immersing the dipper or the sample bottle in the body of water. A sample of a dipper can be seen on Figure 9a.

Note: Samples for VOC analysis are collected first. When obtaining samples for volatile organic analysis, it is important to exclude any air space in the top of the bottle. However, when sampling running water (e.g., a stream or creek), the order in which samples are collected may not be important.

a. Position yourself to collect sample without taking any unnecessary risks.

b. Holding the end of the rod opposite the dipper, lower dipper until it is completely below the surface (or to a specific depth) and collect grab sample. If you are standing in a stream or pond, or can get very close to the stream or pond, you can fill the sample bottles (with no preservatives) directly from the stream. If not, a dipper must be used. For glass sample bottles, a glass dipper must be used. For plastic sample bottles, a plastic dipper must be used.

c. Transfer grab sample to appropriate sample container, continuing until you have collected the necessary number of samples for this location.

d. Remove dipper from the rod and place dipper in a trash bag.

e. Decontaminate the end of the rod, if necessary.

f. Move to the next sampling location.

g. Attach another dipper and repeat steps (a) through (e).

Additional suggestions:

h. The sample container should be rinsed at least once with the water to be sampled before the sample is taken. Be aware that it is fine to rinse the bottles that do not have preservatives, but it is not necessary because all bottles are supposed to be clean that we obtain for the labs. Obviously, bottles with preservatives cannot be rinsed out.

i. For sampling running water, the farthest downstream sample should be obtained first, then move upstream. This avoids contaminating samples by raising the stream turbidity levels. Work from zones of low contamination to zones of high contamination. Always stand on downstream side to avoid sediment contamination.

j. To sample a pond or other standing body of water, the surface area may be divided into grids. A series of samples taken from each grid is combined into one sample, or several grids are selected at random.

k. Stagnated areas or pools in a stream or river might contain zones of varying pollutant concentrations, depending upon the physical or chemical properties of the contaminants and the position of these stagnated areas relative to the site.

l. Avoid excessive agitation of the water since this results in the loss of volatile constituents.

m. Do not sample at the surface unless sampling specifically for a known constituent which is immiscible and on top of the water. Invert the dipper or sample container, lower it to the desired depth, and hold it at about a 45^{o} angle with the mouth of the dipper or sample container facing upstream.

2. Sediment Sampling

Refer to Section X (Sediments).

D. REFERENCES

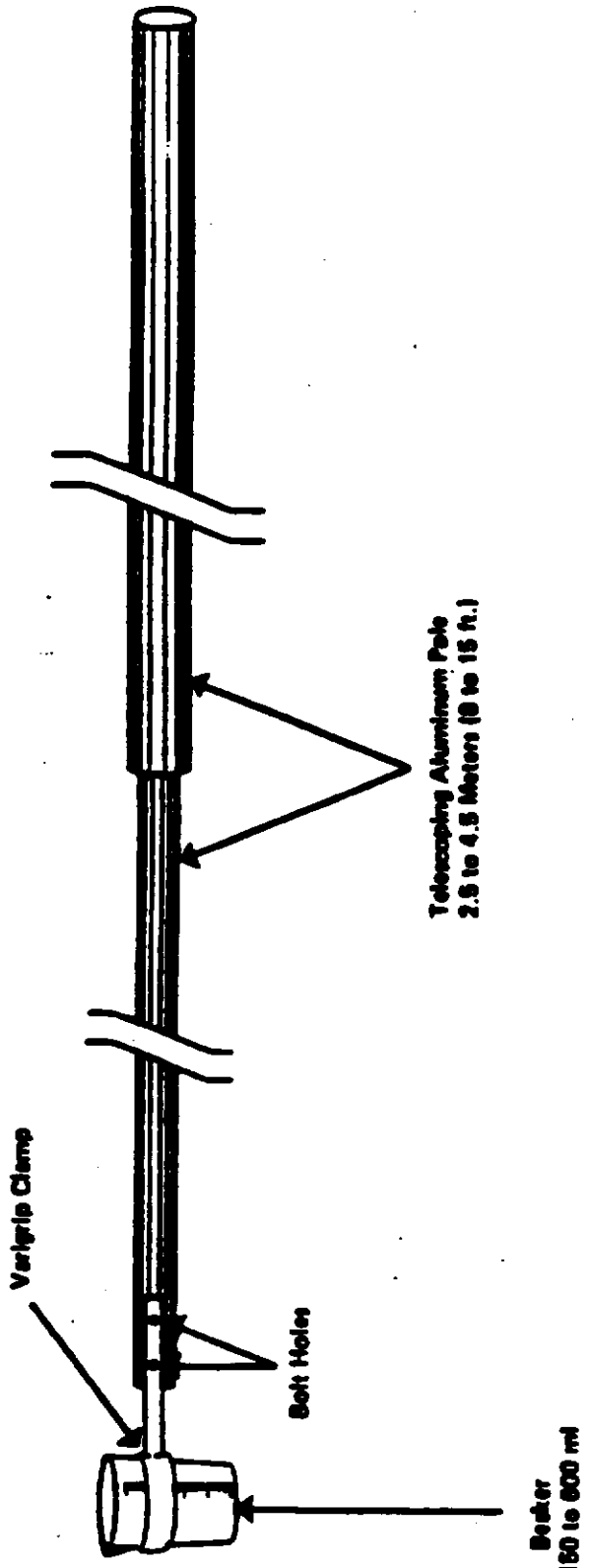
Illinois Environmental Protection Agency, Remedial Project Management Section. Methods & Procedures Manual for Activities Undertaken Under the Preliminary Assessment/Site Inspection Program, 1987.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Volume II, Third Edition.

E. FIGURE

9a -- Disposable Dip Sampler

FIGURE 9a – DISPOSABLE DIP SAMPLER



SECTION X: SEDIMENT SAMPLING

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SECTION X: SEDIMENT SAMPLING

A. REMINDER CHECKLISTS

1. Pre-Sampling Activities

___ Establish purpose(s) of sampling.

___ Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.

___ Assess site hazards and develop and/or review a safety plan.

___ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.

___ Bring enough clean water for rinsing, cleaning, and cooling off.

___ Schedule lab time and order bottles two weeks in advance.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the trip to ensure all sampling team members understand their roles and responsibilities.

___ Identify local suppliers of sampling expendables (e.g. ice, plastic bags), and overnight delivery services (e.g. Federal Express), and recharge of SCBA air tanks (local Fire Dept.).

___ Prepare your sample containers prior to sampling (label and organize).

2. During Sampling Activities

___ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

___ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.

___ If necessary, monitor the air in the area where the sampling is taking place so that you can adjust your level of protection.

___ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.

___ Never composite VOC samples.

___ Wipe off outside of sample bottles prior to placement in cooler.

3. Post-Sampling Activities

___ Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e. IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.

___ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with BOL SOP for Sample Packaging and Shipping.

___ Separate incompatible waste samples so that they are not transported in the same cooler.

___ Seal odorous waste samples in a cooler to avoid breathing vapors or odors during transportation.

___ Transcribe field notes to memorandum form and submit to the Bureau File. Include photographs and a sketch of site with sampling locations clearly identified.

B. EQUIPMENT CHECKLIST

The selection of the sampling devices should be based upon waste properties (e.g. liquid or solid), site factors (e.g. waste accessibility, waste generation practices, and degree of hazard), and the analytes to be quantitated (e.g. VOCs or heavy metals). Ease of use under the site conditions and the degree of hazard associated with using a given device should also be considered. See attached sampling equipment checklist for a list of the equipment used for sampling sediment.

SAMPLING EQUIPMENT CHECKLIST

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book
_____Site Safety Plan

PROJECT MANAGER:

_____Field Logbook
_____Agency Phone Book
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera
_____Camera Batteries
_____Extra Film
_____Pencils & Pens (Waterproof)
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves_____L_____XL
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water

GENERAL SAMPLING EQUIPMENT:

_____Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
1/2-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____TVA
_____pH/Temp/Millivolt Meter
    _____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Safety Glasses
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Tie Wraps
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape
_____Vermiculite

SEDIMENT SAMPLING EQUIPMENT

_____Trowel or Scoop
_____Thin-Wall Tube Auger(s)*
_____Ekman Dredge
_____Ponar Dredge
_____Coring Device
_____Bailer Cord
_____Chem Wipes

* Including handles

C. PROCEDURES

1. Trowel or Scoop - Surface Sediment Sampling Beneath a Shallow Aqueous Layer (Figure 10a).

a. Be certain the trowel or scoop has been decontaminated prior to use.

b. Remove any debris on the bed of the stream or other water body with such tools as a spade, shovel to prepare the surface sediment for sampling, being careful to minimize disturbance or the water and sediment.

c. Using a stainless steel or plastic trowel or scoop, collect a sufficient quantity of surface sediment to provide a representative sample.

d. Collect the first sample for VOC analysis directly from the sampler and transfer to the appropriate sample container(s).

e. When analyses are required for parameters other than VOCs, mix the remainder of the collected sediment to obtain a homogeneous sample, then transfer to the appropriate sample container(s).

f. Return the unused portion of the sample to the sampling point.

g. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

2. Thin-Wall Tube Augers - Surface Sediment Sampling Beneath a Shallow Aqueous Layer (Figure 10b).

a. An acetate core may be inserted into the auger prior to sampling, if characteristics of the sediments or body water warrant. By using this technique, an intact core can be extracted.

b. Insert the auger into the material at a 0° to 45° angle to minimize spillage of the sample. Extraction of samples may require tilting the sampler.

c. Rotate the auger once or twice to cut a core of material.

d. Slowly withdraw the auger, making sure that the slot is facing upward.

e. Collect the first sample for VOC analysis directly from the auger and transfer to the appropriate sample container(s).

f. When analyses are required for parameters other than VOCs, mix the remainder of the collected sediment to a obtain a homogeneous sample, then transfer to the appropriate sample container(s).

g. Return the unused portion of the sample to the sampling point.

h. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

3. Augers and Thin-Wall Tube Samplers - Deep Sediment Sampling Beneath a Shallow Aqueous Layer (Figure 10b).

a. Attach the auger bit to an extension rod, then attach the "T" handle to the extension rod.

b. Clear the area to be sampled of any surface debris using a spade or shovel being careful to minimize the disturbance of the water and bed of the water body.

c. Begin auguring, periodically removing any accumulated sediment from the auger.

d. After reaching the desired depth, slowly and carefully remove the auger from the boring. When sampling directly from the auger, collect the sample after the auger is removed from the boring and proceed to step (l).

e. Remove the auger tip from extension rods and replace with a pre-cleaned thin-wall tube sampler with the proper cutting tip.

f. Carefully lower the tube sampler down the borehole, being careful to not scrap the borehole sides, and gradually force the tube sampler into the sediment. **DO NOT HAMMER THE EXTENSION RODS TO FACILITATE CORING SINCE THE VIBRATIONS MAY CAUSE THE BORING WALLS TO COLLAPSE.**

g. Remove the tube sampler and unscrew the extension rods.

h. Remove the cutting tip and core from the device.

i. Discard the top of the core (approximately one (1) inch), up-hole material collected by the tube sampler prior to reaching the collection point.

j. Collect the first sample for VOC analysis directly from the sampler and transfer to the appropriate sample container(s).

k. When analyses are required for parameters other than VOCs, mix the remainder of the collected sediment to a obtain a homogeneous sample, then transfer to the appropriate sample container(s).

l. Return the unused portion of the sample to the sampling point.

m. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

4. Ekman Dredge - Sediment Sampling from Beneath a Deep Aqueous Layer (Figure 10c).

a. Thread a sturdy nylon rope or stainless steel cable through the bracket of an Ekman dredge, or secure the extended handle to the bracket with machine bolts.

b. Attach springs to both sides. Arrange the Ekman dredge sampler so that the jaws are in the open position and trip cables are positioned over the release studs.

c. Lower the sampler to just above the sediment surface.

d. Drop the sampler sharply onto the sediment.

e. Trigger the jaw release mechanism by lowering a messenger down the line, or by depressing the button on the upper end of the extended handle.

f. Raise the sampler and slowly decant any free liquid through the top of the sampler over the sampling point, being careful to retain the sediments.

g. Open the dredge and transfer sediments to a stainless steel or plastic bucket. Continue to collect additional sediment until sufficient material has been accumulated.

h. Collect the first sample for VOC analysis directly from the sampler and transfer to the appropriate sample container(s).

i. When analyses are required for parameters other than VOCs, mix the remainder of the collected sediment to obtain a homogeneous sample, and then transfer to the appropriate sample container(s).

j. Return the unused portion of the sample to the sampling point.

k. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

5. Ponar Dredge - Sediment Sampling from Beneath a Deep Aqueous Layer (Figure 10d).

a. Attach a sturdy nylon rope or stainless steel cable to the hook provided on the top of the dredge.

b. Arrange the Ponar dredge sampler in the open position, setting the trip bar so the sampler remains open when lifted from the top.

c. Slowly lower the sampler to just above the sediment.

d. Drop the sampler sharply into the sediment, then pull sharply up on the line, thus releasing the trip bar and closing the dredge.

e. Raise the sampler to the surface and slowly decant any free liquid through the screens on top of the dredge being careful to retain sediments.

f. Open the dredge and transfer the sediment to a stainless steel or plastic bucket. Continue to collect additional sediment until sufficient material has been accumulated.

g. Collect the first sample for VOC analysis directly from the sampler and transfer to an appropriate sample container(s).

h. When analyses are required for parameters other than VOCs, mix the remainder of the collected sediment to obtain a homogeneous sample, then transfer to an appropriate sample container(s).

i. Return the unused portion of the sample to the sampling point.

j. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

6. Coring Device - Sediment Sampling from Beneath a Deep Aqueous Layer (Figure 10e).

a. Assemble the coring device by inserting the acetate core into the sampling tube.

b. Insert the "eggshell" check valve mechanisms into the tip of the sampling tube with the convex surface positioned inside the acetate core.

c. Screw the coring point onto the tip of the sampling tube.

d. Screw the handle onto the upper end of the sampling tube and add extension rods as needed.

e. Place the sampler in a perpendicular position to the material to be sampled.

f. If using the "T" handle, place downward pressure on the device until the desired depth is reached. Then rotate the sampler to shear off the core of the bottom, retrieve the device and proceed to Step (o) below.

g. If the drive hammer is selected for consolidated sediments, insert the tapered handle of the drive hammer through the drive head.

h. With the left hand holding the tube, drive the sampler into the material to the desired depth being careful to not drive the tube further than the tip of the hammer's guide.

i. Record the length of the tube that penetrated the sample material, and the number of blows required to obtain the depth.

j. Remove the drive hammer and fit the keyhole-like opening on the flat side of the hammer onto the drive head. In this position, the hammer serves as a handle for the sampler.

k. Rotate the sampler at least two (2) revolutions to shear off the sample at the bottom.

l. Lower the sampler handle (hammer) until it just clears the two (2) ear-like protrusions on the drive head, and rotate about 90°.

m. Withdraw the sampler by pulling the handle (hammer) upwards and dislodging the hammer from the sampler.

n. Unscrew the coring point and remove the "eggshell" check valve.

o. Slide the acetate core out of the sampler tube. The acetate core may be capped at both ends. Collect the first sample for VOC analysis directly from the sampler and transfer to the appropriate sample container(s).

p. When analyses are required for parameters other than VOC's, transfer the remainder of the sample to a stainless steel or plastic bucket and mix to

obtain a homogeneous sample, then transfer to the appropriate sample container(s).

q. Return the unused portion of the sample to the sampling point.

r. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

D. REFERENCES

Reproduced in part from -OSWER Directive 9360.4-03, January 1991.

E. FIGURES

10a -- Trowel (Scoop)

10b -- Thin-Wall Tube and Bucket Augers

10c -- Ekman Dredge

10d -- Ponar Dredge

10e -- Coring Device Sampler

FIGURE 10a – TROWEL (SCOOP)

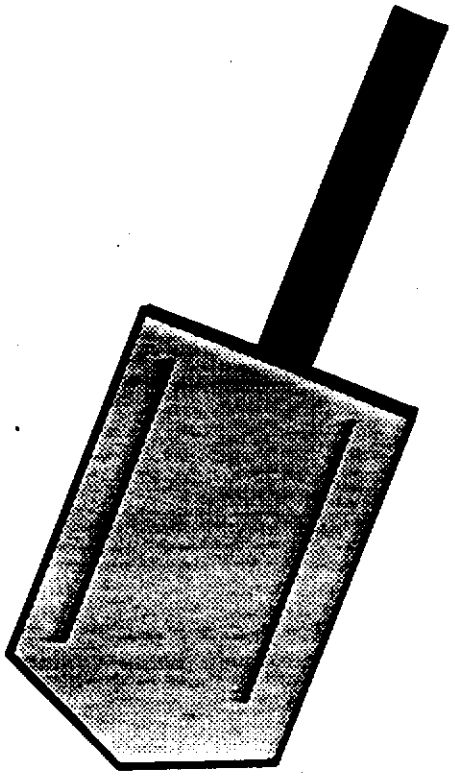


FIGURE 10b – AUGER SAMPLERS

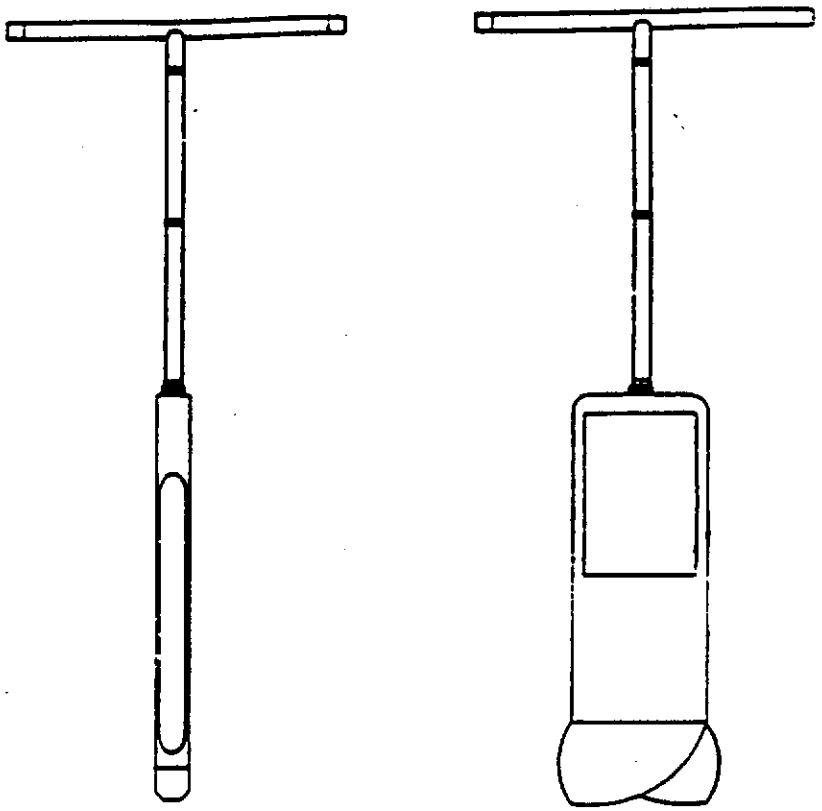


FIGURE 10c – EKMAN DREDGE

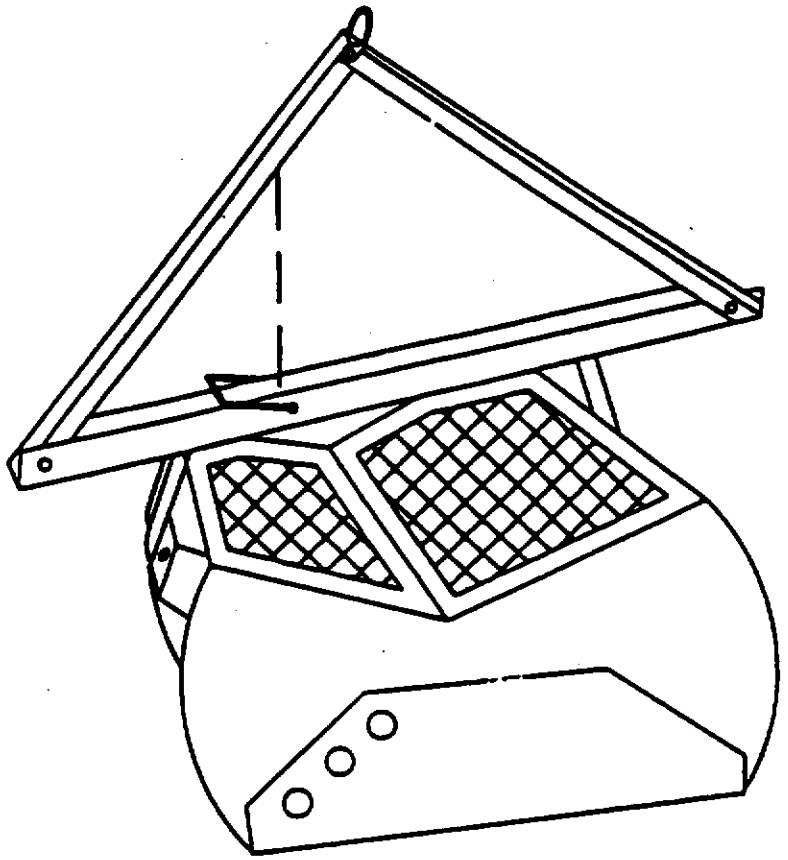


FIGURE 10d – PONAR DREDGE

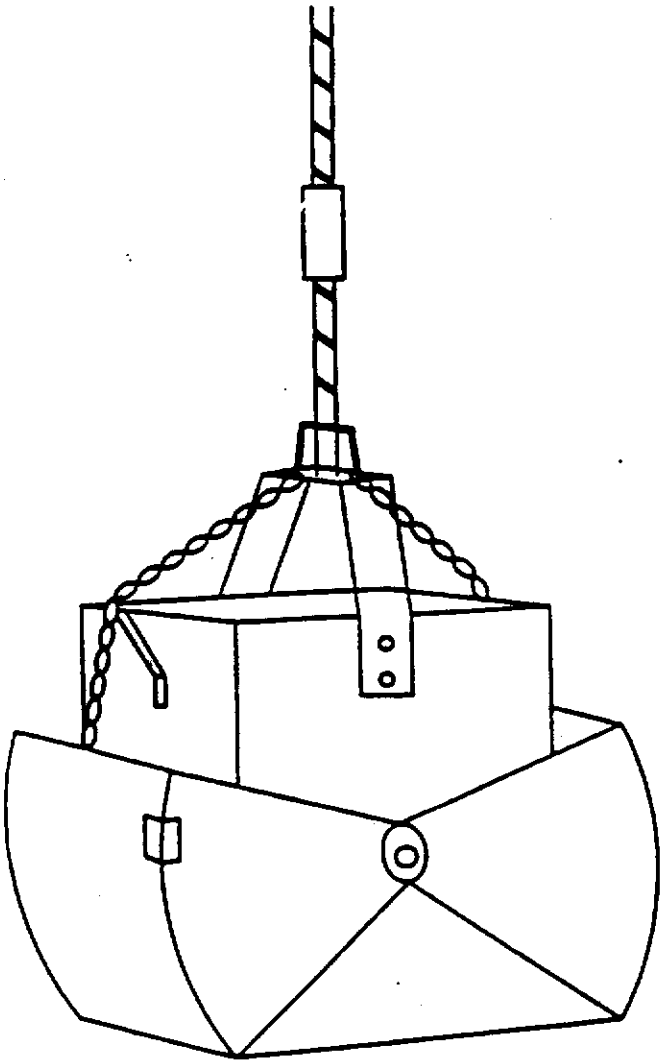
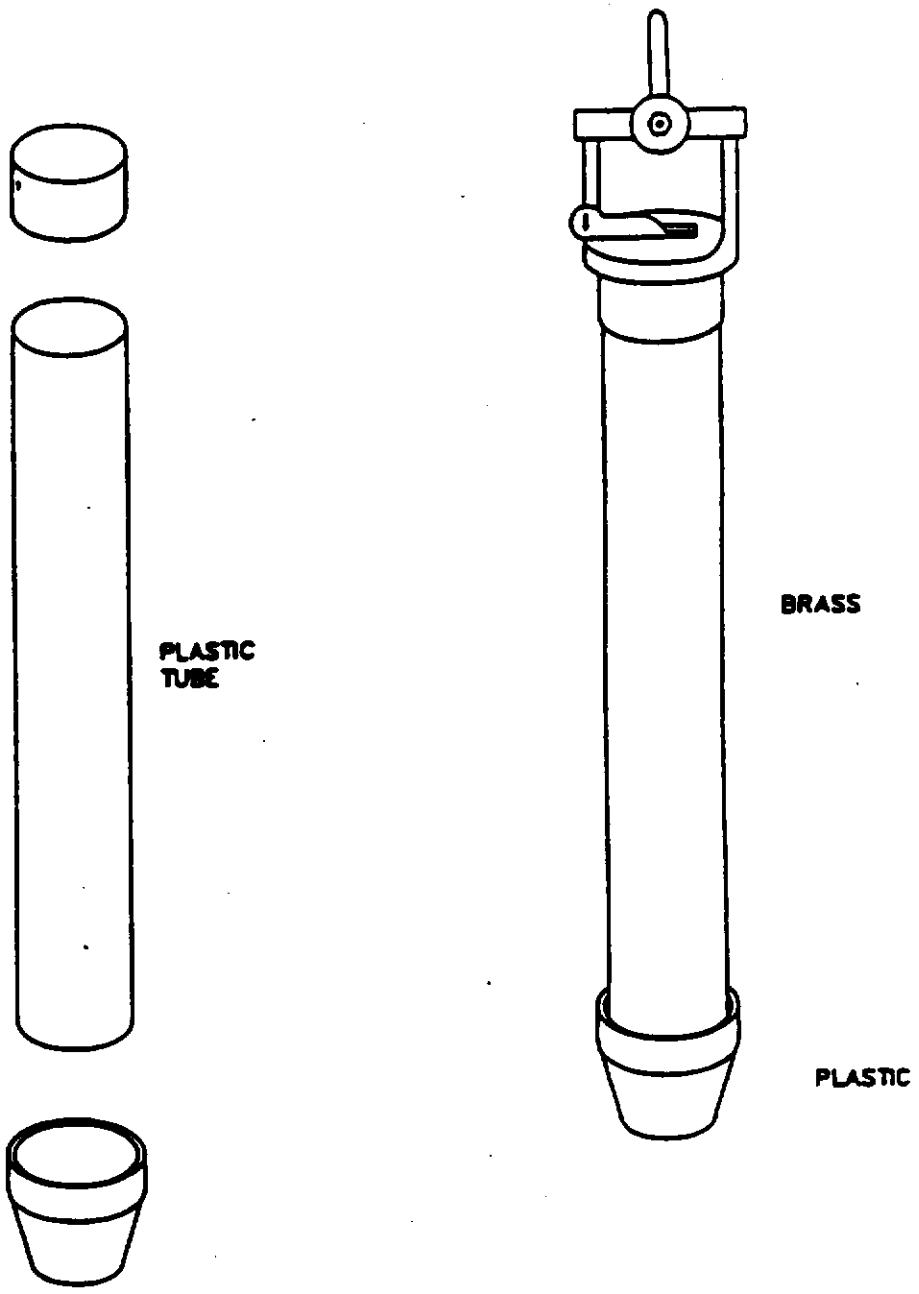


FIGURE 10e – CORING DEVICE SAMPLER



SECTION XI: LEACHATE SAMPLING

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SECTION XI: LEACHATE SAMPLING

A. REMINDER CHECKLISTS

1. Pre-Sampling Activities

___ Assess site hazards and develop and/or review a safety plan.

___ Develop and/or review a sampling plan.

___ Establish purpose(s) of sampling.

___ Obtain necessary sampling and monitoring equipment; decontaminate or preclean the equipment, and ensure that it is in working order.

___ Bring enough clean water for rinsing, cleaning, and cooling off.

___ Schedule lab time and order your bottles 2 weeks in advance.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.

___ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept.).

___ Become familiar with the impoundment, such as where the waste enters the unit, where the waste exits the unit (if applicable), and accessibility to the unit.

___ If sludge samples are required, refer to Section X of this document for additional guidance.

___ Prepare your sample containers prior to sampling (label and organize).

2. During Sampling Activities

___ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

___ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.

___ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.

___ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.

___ Never composite VOC samples.

___ Wipe off outside of sample bottles prior to placement in cooler.

___ Sample bottles with preservatives cannot be overfilled (liquid samples).

___ Photograph sample containers at sample location.

3. Post-Sampling Activities

___ Decontaminate all field equipment and PPE, if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.

___ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with BOL SOP for Sampling Packaging and Shipping.

___ Separate incompatible wastes so that they are not transported in the same cooler.

___ Seal odorous wastes in the cooler to avoid breathing vapors or odors during transportation.

___ Make sure water reactive wastes are not transported with water or ice.

B. EQUIPMENT CHECKLIST

The selection of the sampling devices should be based upon waste properties (e.g., liquid or solid), site factors (e.g., waste accessibility, waste generation practices, and degree of hazard), and the analytes to be quantitated (e.g., VOCs or heavy metals). Ease of use under the site conditions and the degree of hazard associated with using a given device should also be considered. Refer to following table to determine equipment needs.

SAMPLING EQUIPMENT CHECKLIST: LEACHATES

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book

PROJECT MANAGER:

_____Field Logbook
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera
_____Camera Battery
_____Pencils & Pens
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves_____L_____XL
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water

GENERAL SAMPLING EQUIPMENT:

_____Sample Bottles
_____Clean Glass Tubes
_____Extra Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
1/2-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____TVA
_____pH/Temp/Millivolt Meter
_____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Field Chairs
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape

SPECIFIC SAMPLING EQUIPMENT:

Refer to the appropriate Sampling Equipment Checklist referenced.

C. PROCEDURES

Collection of leachate samples may involve the collection of liquid, sediment, sludge, or soil samples, depending on where the leachate is found. For instance, if leachate migrates from its source, it could come in contact with soil or with a stream. When sampling leachate, it is very important to document the source of the leachate and its flow paths, surrounding surface drainage patterns, and locations and flow direction of streams and intermittent streams. This information is needed to interpret and compare analytical results to appropriate water quality standards. Document the samples with photos and a well-drawn site map with sample locations, leachate flow paths and surface drainage patterns.

Take extra safety precautions when filling sample bottles that contain preservatives. Violent reactions could occur between the leachate and the preservative. Consider using unpreserved VOC bottles to avoid loss of volatiles. If unpreserved bottles are used, inform the lab and make a notation on the sampling paperwork. For leachates that react with the HCL preservative, use a vial without the HCL preservative and label it with the words "NOT ACIDIFIED." The lab will then run the sample more quickly to comply with the shorter holding time for unpreserved VOC samples. A sample of a vial can be seen on Figure 11a. Make sure appropriate protective gear is worn and all necessary safety precautions are taken prior to collecting samples.

1. Liquid Sampling

Refer to Sections IV (Surface Impoundments) and IX (Surface Water) for the appropriate sampling technique. The sample collector might consider compositing leachate samples if he/she is trying to evaluate compliance with 35 IAC, Part 304 effluent standards (see Section 304.104).

2. Sediment Sampling

Refer to Section X (Sediments).

3. Sludge Sampling

Refer to Section X (Sediments).

4. Soil Sampling

Refer to Section VI (Surface and Subsurface Soils).

D. REFERENCES

Illinois Environmental Protection Agency, Remedial Project Management Section. Methods & Procedures Manual for Activities Undertaken Under the Preliminary Assessment/Site Inspection Program, 1987.

SECTION XII: SAMPLING FOR LEAD-BASED PAINT CHIPS AND DUST

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SECTION XII: SAMPLING FOR LEAD-BASED PAINT CHIPS AND DUST

The following procedures are recommended for the investigation of complaints related to the uncontrolled removal of lead-based paint from exterior surfaces such as water towers, bridges, homes, and commercial buildings. If further guidance is needed, please contact Connie Sullinger with the Office of Chemical Safety at 217-785-0830.

A. REMINDER CHECKLIST

1. Pre-Sampling Activities

___ Review the site safety plan (SSP) if one exists. If a SSP is not available, assess site hazards and develop a SSP. A computer program has been developed to help generate a SSP and is available from the Health and Safety Unit. Alternatively, a generic, fill-in-the-blanks, SSP is provided in Section XV.

___ Establish purpose(s) of sampling.

___ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.

___ Bring enough clean water for rinsing, cleaning and cooling off.

___ Schedule lab time and order your bottles 2 weeks in advance.

___ Be prepared to sample in extreme weather conditions, if applicable.

___ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.

___ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Department).

___ If possible, arrange to have the complainant or another informed individual available to identify the areas of contamination. Removal methods such as sanding or abrasive removal create fine dust that may not be obvious to the

eye once deposited onto horizontal surfaces. An eyewitness can make the gathering of samples easier and more accurate.

___ High priority should be given those sites that involve potential exposure to children six and under and pregnant women.

___ If the removal involves a single family, multi-family residence, or day care center, contact the Illinois Department of Public Health contact person listed on Attachment A. For complaints in Cook County, contact Cheryl Walls with the Cook County Department of Public Health at 708-445-2530. For complaints in the City of Chicago, contact Cato Kirksey with the City of Chicago Department of Health at 312-746-6589. Conducting the removal of lead-based paint from residential structures and daycare facilities in a manner not allowed by the Illinois Department of Public Health is a violation of the Lead Poisoning Prevention Act.

___ Prepare your sample containers prior to sampling (label and organize).

2. During Sampling Activities

___ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

___ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.

3. Post-Sampling Activities

___ Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.

B. EQUIPMENT CHECKLIST

___ Soil sample bottles and trowels should be taken to the site for the collection of waste residues, leaded dust, and potentially contaminated soil.

___ Disposable wipes--The following wipe media have been found to be sufficiently durable under field use and have demonstrated acceptable recovery rates (80-120%): "Little Ones Baby Wash Cloths™", "Little Ones Baby Wipes Natural Formula™", Little Ones Baby Wipes Lightly Scented™", "Pure and Gentle Baby Wipes™", "Fame Baby Wipes™", and individually-packaged "Wash'n Dri Wipes™". Wipes should not contain aloe.

___ Disposable gloves in order to prevent cross-sample contamination from hands. (Latex surgical gloves are acceptable for this type of sampling.)

___ Template Options

a. Masking tape can be used to define the area to be wiped. If using masking tape, take along a measuring tape in order to define the area sampled.

b. Disposable templates can be used, especially for floors, and are typically 1 ft^2. Templates are usually not used for windows due to the variability in size and shape.

SAMPLING EQUIPMENT CHECKLIST

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book

PROJECT MANAGER:

_____Field Logbook
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera/Battery/Film
_____Disposable Wipes
_____Pencils & Pens
_____Measuring Tape
_____Disposable Template
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves_____L_____XL
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water

GENERAL SAMPLING EQUIPMENT:

_____Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
1/2-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____pH/Temp/Millivolt Meter
_____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Field Chairs
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape

C. SAMPLING PROCEDURES

1. Sampling Soil for Waste Residue (Chips and Dust)

a. The scraping of lead-based paint generates chips and dust that are found within a few feet of the building. Check to see if paint chips are present. Examine grass and soil carefully for contamination. Chips and dust can quickly filter through grass and loose soil and therefore may not be apparent without close inspection.

b. Soil samples should be taken within the top few inches of soil. Make drawings of sample locations relative to the source area.

c. Take a sample of the lead-based paint waste residue. If possible, take enough sample (at least 100 grams or 4 oz. by weight) so that a Toxicity Characteristic Leaching Procedure (TCLP) for waste characterization can be run if needed.

d. Samples should be obtained of potentially impacted off-site areas to indicate dispersion of the lead from the source area. Focus on children's play areas, gardens and areas of bare soil.

e. Lead paint dust can be present but invisible. If wipe samples are necessary, take samples in locations most likely impacted by the deposition of leaded dust from the removal operation.

f. If the age of the housing leads you to suspect the presence of lead-based paint and target populations (children 0-6 years and pregnant women) are present, the laboratory turn-around time should be <u>seven</u> days. Contact OCS for arrangements.

g. Soil and wipe samples should be analyzed for TOTAL lead. If a waste classification is needed, the waste residue samples should be analyzed for TCLP extractable lead.

h. Take pictures of the site and potential contamination.

i. A copy of the analytical results should be sent to Connie Sullinger in the Office of Chemical Safety, #28.

j. The approximate age of the housing should be noted due to the fact that lead-based paint was banned from use in residential exterior and interior household paint in 1978. The highest concentrations of lead, up to 50%, can be found in those paints marketed and used before the 1940s.

2. Wipe Sampling for Settled Lead Dust

a. Outline Wipe Area

1. Floors--apply masking tape to area of about 1 ft^2 or use disposable template. The masking tape should be positioned in a straight line and corners should be nominally perpendicular. Avoid touching the area to be wiped while putting tape or template in place.

2. Window sills or other rectangular surfaces--Apply two strips of masking tape across the sill to define a wipe area at least 0.1 ft^2 in size (approximately 4 inches x 4 inches).

3. For irregular surfaces, it will not be possible to do this. Instead, it will be necessary to measure the area sampled following the procedures in d.

b. Obtain disposable wipe--When using a container that dispenses wipes through a pop-up lid, dispose of the first wipe in the dispenser. Rotate the container before starting to ensure liquid inside the container contacts all of the wipes.

c. Conduct wipe sampling

1. Place the wipe at one corner of the surface to be wiped with wipe fully opened and flat on the surface.

2. With the fingers together, grasp the wipe between the thumb and the palm. Press down firmly, but not excessively with both the palm and fingers (do not use the heel of the hand). For square areas, wipe side-to-side with as many "S"-like motions as are necessary to completely cover the entire wipe area. Exerting excessive pressure on the wipe will cause it to curl. Exerting too little pressure will result in poor collection of dust. Attempt to remove all visible dust from the wipe area.

   Fold the wipe in half with the contaminated side facing inward. Once folded, place in the top corner of the wipe area. Repeat wiping the area with "S"-like motions, but move in a top-to-bottom direction. When finished, fold the wipe with the contaminated side facing inward and place wipe in sampling container.

For rectangular areas such as window sills, two side-to-side passes must be made, the second pass with the wipe folded so that the contaminated side faces inward. It is not necessary to wipe the entire window but do not wipe less than 0.1 ft^2 (approximately 4 inches x 4 inches).

d. After sampling, measure the surface area wiped to the nearest eighth of an inch. The size of the area wiped must be at least 0.1 ft^2 in order to obtain an adequate limit of quantitation.

e. Wipe samples should be analyzed for TOTAL lead.

D. REFERENCES

United States Department of Housing and Urban Development. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing., June 1995.

See Also:

American Society for Testing and Materials. ASTM Standards on Lead-Based Paint Abatement in Buildings. ASTM, Philadelphia, PA., November 1994.

SECTION XIII: ASBESTOS SAMPLING

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SECTION XIII: ASBESTOS SAMPLING

PREFACE

- After November 28, 1992, the Asbestos Hazard Emergency Response Act (AHERA) requires all persons inspecting for asbestos or designing or conducting asbestos response actions in public and commercial buildings to be accredited in accordance with the Model Accreditation Plan

- Inspecting is defined as:

  an activity undertaken to determine the presence or location, or to assess the condition of friable or nonfriable Asbestos Containing Building Material (ACBM) or suspected ACBM, whether by **visual** or physical examination, or collecting samples of such material.

- Public and commercial buildings are defined as follows:

  - the interior space of any building which is not a school building;

  - includes industrial facilities, office buildings, government-owned buildings, colleges, churches, hospitals, stores, factories, etc.;

  - excludes residential apartment units of fewer than 10 units and detached single family homes.

- **Persons who violate these requirements are subject to penalties of up to $5,000 per day, per violation.**

When Bureau of Land personnel encounter ACBM or suspected ACBM in public or commercial buildings they should contact the Bureau of Air Field Operations Section to request assistance and guidance.

A. REMINDER CHECKLIST

___ The following specific procedures should be followed to prepare aqueous sample bottles.

___ Use only unused pre-cleaned glass bottles (polypropylene should be avoided since problems of particulate being released into water samples have been reported.)

___ Before use the bottles should be rinsed twice by filling one-third full with fiber-free water and shaking vigorously for thirty seconds.

B. EQUIPMENT

The appropriate equipment for sampling asbestos depends on the media being sampled. Refer to the media specific sampling procedures (e.g. waste piles, soils, sediments, surface waters) for a description of the appropriate equipment to be used for sampling for asbestos.

1. Sample container for Bulk / Solid Samples should be an unused 35mm canister or ziplock bag or pre-cleaned screw-capped 4 ounce wide mouth glass jar.

2. Sample container for Aqueous Samples should be an unused, pre-cleaned one liter glass bottle (see checklist above).

C. PROCEDURES

Refer to the procedures in this manual which are specific to the media being sampled. No more than a "thimble full" is required for bulk samples.

SECTION XIV: SURFACE WIPE SAMPLING

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C. REFERENCES 14.10

SECTION XIV: SURFACE WIPE SAMPLING

A. REMINDER CHECKLIST

1. Pre-Sampling Activities

___ Assess site hazards, and develop and/or review a safety plan.

___ Develop and/or review sampling plan.

___ Establish purpose(s) of sampling.

___ Obtain necessary sampling equipment and supplies:

Wipe media (as appropriate).

- ___ 3" X 3" soxlet extracted cotton gauze pads.
- ___ 7 cm (2.8-inch) Whatman 42 filter paper.
- ___ Commercially available baby wipes (see Lead-Based Paint Residue Method below).

Wipe solvent (as appropriate).

- ___ Distilled, Deionized water.
- ___ Hexane (Pesticide grade).
- ___ Other appropriate organic solvent (Pesticide grade or equivalent).

___ Sample containers (glass with Teflon® lined lid).

___ Disposable gloves, at least one pair for each sample and compatible with the solvent used.

___ Metal Ruler (approximately 6-inches or larger) graduated in centimeters.

___ Masking template for sample area of 100 cm^2.

- ___ Prepared template (10 cm X 10 cm), or
- ___ Non-corrugated cardboard (such as plain manilla file folders - no colors) for making templates.

___ Masking tape to hold templates in place.

___ X-Acto® or equivalent knife for cutting templates in the field or to fit odd shaped surfaces.

___ Prepare sample containers (by inserting wipes and solvent in each) if appropriate.

___ Obtain waste container for used PPE, used templates and excess solvent.

___ Schedule lab time two weeks in advance when possible.

___ Be prepared to sample in extreme climatic conditions.

___ If necessary, contact the site owner/operator prior to the sampling event to obtain permission to gain access to the site, to discuss the purpose of the sampling, to address any safety and security concerns at the site, and to coordinate replicate samples if requested by the owner/operator.

___ Determine the number and type of QA/QC samples necessary for the sampling objectives.

___ Sample documents and chain-of-custody forms.

___ Camera and film or videocam, as necessary to document sample location.

___ Cooler and icepacks to maintain $4^{o}C$ during sample shipment.

___ When necessary, packing materials for shipping the sample(s).

2. During Sampling Activities

___ Document the sampling event. At a minimum, the ambient temperature, date, time, sampler's name, photos or video, any deviations from the original sampling plan, and any problems encountered.

___ Collect the samples in areas of least expected contamination first.

___ Collect any media blanks before collecting samples.

___ If necessary monitor air in breathing zone of sampler to determine if respiratory protection level is appropriate.

___ Wipe off sample bottles prior to placing in cooler.

___ Change outer disposable gloves between individual wipe sample locations.

___ Keep sample bottles in coolers at $4^{o}C$, sealed and maintain chain of custody.

3. Post-Sampling Activities

___ Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin. Label any malfunctional equipment and notify its custodian.

___ Classify and properly dispose of all waste generated properly.

___ Keep all samples cool and ship or deliver to appropriate laboratory.

B. PROCEDURES

1. Field Quality Assurance and Quality Control

a. Prevention of Cross Contamination

By its nature wipe sampling involves a lot of hand contact with various surfaces that may easily result in cross contamination. The key to prevention is the appropriate sequencing of actions to eliminate opportunities for cross contact. Performing a "dry run" of the sampling process should identify adjustments that need to be made. Details like having: the waste container open and ready, the sample bottles pre-labeled, spare gloves accessible, etc. are key to preventing the entire sampling and analysis effort being negated because of cross contamination.

Because the wipe sampling involves so much hand contact, frequent glove changes are necessary to avoid cross contamination. Therefore the gloves selected should be economical, yet be compatible with the solvent used and not contribute contamination of itself. Depending upon the contaminant and solvent media, an inner protective glove of more durable construction/materials may be combined with a cheaper outer glove which is changed frequently (with each sample). It may also be helpful to wrap the exterior of sample containers.

b. QA/QC Samples

Where the potential exists for pre-existing contamination of the sample media, media blanks should be obtained. In the case of wipe samples this would include using the gloves, solvent and wiper to wipe one of the templates and then containerizing the exposed wiper in a sample jar just like an objective sample would be handled. Of course the number of blanks used and whether they would be analyzed would depend upon the sampling objectives and the outcome of the objective samples analyses. It would not be necessary to actually analyze the blanks if the objective samples were

non-detect or below a level of regulatory concern for the contaminants of interest. Generally one blank should be collected for every ten wipe samples taken at a sampling session.

2. Selection of Methodology

With the exception of a few chemicals, such as lead and polychlorinated biphenyls, there are not currently any widely accepted protocols for determining acceptable levels applicable to wipe samples. This fact significantly limits the applicability of wipe samples as proof of cleanup to levels protective of human health and the environment. However, this may change in the future. On the other hand wipe samples are currently useful in determining the presence or absence of contamination, within the detection range of the analytical method.

Most current wipe sample methodologies specify a 100 cm^2 area of substrate being wiped. While increasing the area and then scaling back the results can increase the sensitivity, by effectively lowering the detection limit per area, there is a greater chance that the wipe material will become abraded and sample will be lost.

The selection of solvent is also important. The solvent used must readily dissolve the contaminant(s) of interest and yet be compatible with the analytical method. Solvents of suitable purity are also important and purity level should be selected in consultation with the lab. Common solvents are DI or Nanopure water, methanol, hexane and methylene chloride. Also to be considered is that the solvent chosen should not damage the surface being sampled. When skin is the sampled surface, only water should be used as other solvents may increase the absorption of contaminants through the skin. When conducting the sampling, the wipes used should be wetted consistently with the solvent, the wipe conducted and the sample sealed in the sample containers quickly to assure consistent transfer and retention of the contaminant(s) of interest. To assure consistent wetting it is often recommended that wipes be pre-wetted in the sample containers with a measured amount of solvent and be allowed to equilibrate.

Selection of the sample location affects the consistency of wipe samples in that smooth surfaces, such as glass, metal, and painted surfaces, are more likely to result in maximal transfer of contaminant(s) to the wipe while rougher surfaces such as unsurfaced concrete, brick or textiles are more likely to retain more of the contaminant(s) in pore spaces and other crevices which the wipe cannot effectively reach. Wiper materials such as glass wool may be more effective on rougher surfaces. Other materials used as wipers include glass wool, analytical chemist's filter paper, gauze pads.

3. Sample Locations

There are three strategies for selection sample locations. The first is to randomly select the sample locations. This is generally appropriate when a relatively large number of samples will be taken and statistical manipulations are anticipated of the sample data. The number of samples and the determination of random locations can be determined in a similar manner used for other surface media sampling.

The second strategy is to sample areas of suspected high contamination. These can be selected based on visual stains or proximity to a suspected source. Consideration of the means of contaminant transport and the affinity of the receiving surface for the contaminant can also indicate likely locations of high contamination. This strategy is most applicable for initial screening for the existence of contamination.

The third strategy is to sample areas that are most likely to form part of a future expose pathway. For instance, these might be areas where skin contact is likely or where high contact is likely with secondary surfaces such as shoes that can transfer the contaminant to tertiary surfaces which may have high skin contact rates, such as residential carpets. This strategy can be employed to confirm cleanup when relatively few samples will be taken.

4. Sample Collection

a. TSCA PCB Sampling Method [1,2,3]

If the surface to be samples is smooth and impervious (e.g., rain gutters, aluminum house siding), a wipe sample should indicate whether the cleanup has sufficiently removed the PCBs. These surfaces should be sampled by first applying an appropriate solvent (e.g., hexane) to a piece of 11 cm filter paper (e.g., Whatman 40 ashless, Whatman "50" smear tabs, or equivalent) or gauze pad. This moistened filter paper or gauze pad is held with a pair of stainless steel forceps and used to thoroughly swab a 100-cm^2 area as measured by a sampling template.

Care must be taken to assure proper use of a sampling template. Different templates may be used for the variously shaped areas which must be sampled. A 100 cm^2 area may be a 10 cm x 10 cm square, a rectangle (e.g., 1 cm x 100 cm or 5 cm x 20 cm), or any other shape. The use of a template assists the sampler in the collection of a 100 cm^2 sample and in the selection of representative sampling sites. When a template is used it must be thoroughly cleaned between samples to prevent contamination of subsequent samples by the template.

The wipe samples should be stored in precleaned glass jars at 4° C. Before collection of verification samples, the selected filter paper or gauze pad and solvent should be used to generate a field blank.

Wipe sampling is inappropriate for surfaces which are porous and would absorb PCBs. These include wood and asphalt. Where possible, a discrete object (e.g., a paving brick) may be removed. Otherwise, chisels, drills, saws, etc., may be used to remove a sufficient sample for analysis. samples less than 1 cm deep in the surface most likely to be contaminated with PCBs should be collected.

The approved IEPA QAPP[2] for TSCA samples specifies that the appropriate container for wipe samples is 125 ml amber glass jar with a Teflon lined cap that is stored at 4° C.

The PCB Inspection Manual [3] indicates that isooctane be used instead of hexane and also indicates that using a rubber glove to hold the paper or pad, dip it into isooctane and to thoroughly rub it over a 100 cm^2 area is acceptable.

b. NIOSH Chlorinated Dioxin and Furan Method [4]

Surface samples for PCBs, PCDFs, and PCDDs will be collected according to the wet-wipe protocol established by the New York State Department of Health for surfaces in the Binghamton state Office Building. This wet-wipe protocol was also used to assess these contaminants resulting from transformer fires in San Francisco and Tulsa.

The surface wipe samples are collected using 3" x 3" soxlet extracted cotton gauze pads. The sampling procedure consists of marking off a surface into 0.25 m^2 areas using a template or an appropriate measuring device. Each area is wiped with a 3" x 3" gauze pad which has been wetted with 8-ml of pesticide grade hexane. The wet wipe sample pad is wiped in two directions (the second direction is performed at a 90° angle to the first direction). Each gauze pad is used to wipe only one 0.25 m^2 area. The gauze pad is placed in a glass sample container equipped with a Teflon® lined lid.

Each PCB wipe sample will consist of a single sample from an area of 0.25 m^2. The four PCDF/PCDD gauze pads are composited and treated as a single sample to attain an acceptable detection limit.

c. OSHA Method [5]

This procedure is used in conjunction with other situation specific information to establish whether or not there is a health risk due to a potential for dermatitis and/or that a hazardous quantity of a material can be absorbed through the skin on contact with a sampled surface. It can also be used to evaluate potential ingestion hazards.

Using a clean, impervious disposable glove, remove a "Whatman 42' 7-cm (2.8-inch) filter from its box. Moisten the filter with water (unless other collection media have been specified). If possible, wipe approximately 100-cm^2 of the area with the moistened filter. Without allowing the filter to contact other surfaces, fold it with the exposed side in, and then fold it over to form a 90° angle in the center of the filter. Place a filter, angle first, into a clean glass vial, replace the top, and seal it with evidence tape.

A blank filter also moistened with water (or the collection medium) should be submitted in a separate vial to the laboratory with the samples.

OSHA has a field screening test for carcinogenic aromatic amines in which 5 drops of methanol replaces the water and is placed in the center of the filter paper. After sampling, 3 drops of fluorescamine is applied to the contaminated area of the filter and one drop to a non-contact area of the filter as a blank indication. After a reaction time of 6 minutes, the filter is irradiated with 366 mm ultraviolet (UV) light. Differential discoloration of the blank and sample area is presumptive for aromatic amine contamination and another sample should be obtained with the methanol solvent and sent to a lab for confirming analysis. The aromatic amines which turn yellow with fluorescamine are: Benzidine, 4,4'-Methylene bis(2-chloroaniline), 3,3'-Dichlorobenzidine, alpha-Naphthylamine, beta-Naphthylamine, and 4-Aminobiphenyl.

d. Lead-Based Paint Residue Method

See Section XII for specifics on wipe sampling for lead dust.

e. Generic Considerations

When a specific sampling methodology is not specified for contaminant(s) of interest, several factors need to be considered. The first is that the materials used for sampling are compatible with the contaminant(s) and do not degrade or change the contaminants in a manner that precludes their subsequent detection. The second factor is that the size of the area sampled must be proportioned such that the analytical method used will detect a mass of contaminant that when related to the area sampled will be within the range of the "clean" threshold target value. The third factor is that the analytical

method chosen must be for the chemical speciation upon which toxicity values are based (i.e., ionized vs. total metal speciation).

C. REFERENCES

1. Verification of PCB Spill Cleanup by Sampling and Analysis, USEPA (August 1985), EPA-560/5-85-025; pages 41 and 42.

2. Quality Assurance Program Plan, Illinois EPA, Toxics Substances Control Act, PCB Inspection Program (August 1990); Section 6, page 2 of 3.

3. PCB Inspection Manual , USEPA (DRAFT-November 1992), page 5-16.

4. Final Test Plan, Sampling and Analysis of Surfaces and Air for Polychlorinated Biphenyls, Dibenzofurans and Dibenzodioxins: Annex Building, New Mexico State Highway Department, NIOSH (DRAFT--August 1985).

5. "U.S. Ocupational Safety and Health Administration. Office of Science and Technical Assesment. Sampling for Surface Contamination: Section I - Chapter 2 of OSHA Technical Manual, OSHA Instruction TED series, No. 1.15. Washington, D.C. : U.S Department of Labor, May 24, 1996.

SECTION XV: SAMPLING WITH THE GEOPROBE

TABLE OF CONTENTS

SECTION XV: SAMPLING WITH THE GEOPROBE

A. REMINDER CHECKLISTS

1. Pre-Sampling Activities

___ Assess site hazards and develop and/or review the site safety plan.

___ Develop and/or review the sampling plan.

___ Establish purpose(s) of sampling.

___ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.

___ Schedule the Geoprobe unit for use as well as an operator.

___ Bring enough clean water for rinsing, cleaning, and cooling off.

___ Schedule lab time and order bottles.

___ Be prepared to sample in extreme weather conditions.

___ Schedule a meeting prior to the trip to ensure all sampling members understand their roles and responsibilities.

___ Schedule a JULIE or DIGGER meet.

___ Review site geology, hydrogeology, and potential contaminants and their behavior.

___ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.

___ Identify local suppliers of sampling expendables)e.g. ice, plastic bags, overnight delivery, and recharge of SCBA air tanks if necessary.

___ Prepare your sample containers prior to sampling (label and organize).

2. During Sampling Activities

___ Document the sampling event - at a minimum include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

___ Collect samples in order of volatilization. Special care is needed when collecting VOC samples.

___ If necessary monitor the air in the area where sampling is taking place so that you can adjustyourt level of protection.

___ Keep sample bottles in coolers properly preserved, sealed, and maintain chain of custody.

___ Never composite VOC samples.

___ Wipe off the outside of the sample bottles prior to placement in cooler.

___ Perform a general site survey prior to site entry.

___ Identify all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All locations must be utility-cleared.

___ Always take background samples from the same soil types and from similar depths as the on-site samples.

3. Post-Sampling Activities

___ Decontaminate all field equipment, and PPE if appropriate, in accordance with the Health and Safety Plan. Return all usable equipment to the IEPA warehouse or its place of origin.

___ Classify all waste generated (i.e. IDW, baggies, contaminated PPE) and dispose of properly.

___ Keep samples cool; ship or drop off to appropriate laboratory.

___ Separate incompatible wastes so that they are not transported in the same cooler.

___ Seal odorous wastes in a cooler to avoid breathing vapors or odors during transportation.

___ Transcribe field notes to memorandum form or report form and submit to the Bureau File, include photographs and a sketch of the site with sampling locations clearly identified.

B. EQUIPMENT CHECKLIST

See the checklist on the following page for appropriate sampling equipment.

SAMPLING EQUIPMENT CHECKLIST

PAPERWORK:

_____IEPA Identification
_____Safety Training Certification
_____Lab Phone Numbers
_____Site Map & Directions
_____Chemical Analysis Forms
_____Chain of Custody Forms
_____Receipt for Samples (RCRA sites only)
_____Field Log Forms or Field Log Book

PROJECT MANAGER:

_____Field Logbook
_____Aluminum Case (for paperwork)
_____Calculator
_____Camera
_____Pencils & Pens
_____China Markers
_____Compass
_____Pocket Knife
_____Emergency Raingear
_____Paper Towels
_____PPE Gloves
_____pH Paper
_____Decon Spray Bottles:
    _____Liquinox Solution
    _____Deionized/Distilled Water

GENERAL SAMPLING EQUIPMENT:

____Geoprobe and Operator

_____Sample Bottles
_____Extra Bottle Labels
_____Waterproof Clear Tape
_____Visqueen (pre-cut)
_____Utility Knife or Pocket Knife
_____Portable Table
_____Garbage Bags
_____Rain Canopy & Poles
_____Nylon Rope
_____Water Carriers
_____Paper Towels
_____Duct Tape
_____Masking Tape
_____Flashlights & Batteries
_____Binoculars
_____Aluminum Foil
_____Shovel
_____Trowel/Sampling Spoons
_____Macheté
_____Extra Tubing
_____Peristaltic Pump
_____Bailers
_____Disposable Filter Cartridge

FOR DECON:

Spray Bottles:
    _____Liquinox Solution
    _____Distilled/Deionized Water
½-Gallon Jugs:
    _____HCL; dilute to 5 or 10%
    _____Liquinox Solution
    _____DI Water
5-Gallon Sprayers:
    _____Liquinox Solution
    _____Tap Water
_____Extra Gallons of DI Water
_____Paper Towels
_____Aluminum Foil
_____Brushes
_____Plastic Tubs
_____5-Gallon Plastic Buckets
_____Garbage Bags

FOR FIELD MEASUREMENTS:

_____Passport
_____PID
_____FID
_____pH/Temp/Millivolt Meter
    _____Battery; 9-volt
_____pH Buffers; 4, 7, & 10
_____Radiation Detector
_____Draeger Pump, Tubes

PPE, SAFETY & SUPPORT:

_____Cleaning & Cooling Water
_____Drinking Water
_____Gatorade
_____Ice for Drinking Water
_____Hand Soap/Goop
_____First Aid Kit
_____Insect/Tick Repellant
_____Sunscreen
_____Fire Extinguishers
_____Walkie Talkies
_____Full-Face Respirators
_____Cartridges
_____SCBAs
_____Cylinders
_____Field Chairs
_____Disposable Booties
_____Tyvek
_____Saranex
_____Raingear
_____Cotton Coveralls
_____Insulated Coveralls
_____Steel-Toed/Shanked Boots
_____Insulated Pack-Boots
_____Hardhat/Face Shields
_____Nitrile/Butyl Rubber/Neoprene Gloves
_____Glove Liners

SEALING & TRANSPORTATION:

_____Coolers
_____Blue Ice
_____Dry Ice
_____Regular Ice
_____Large Liners for Coolers
_____1-Gallon Ziplock Bags
_____Quart Ziplock Bags
_____Large FDA Cooler Bags
_____Evidence Tape
_____Strapping Tape

C. COMPLETE GEOPROBE EQUIPMENT LIST

The following is a list of equipment that is necessary to operate the Geoprobe. This equipment will be necessary in addition to the sampling equipment on the previous checklist. In most instances the Geoprobe operator will be responsible for gathering this equipment and making sure that it is working order.

___ One utility vehicle with the Geoprobe model 8A mounted.

___ Hardened steel rod, 3 feet long, 1-inch OD, ½-inch ID.

___ Drive caps.

___ Anvil.

___ Expendable drive point.

___ Sampling cap.

___ Pull cap.

___ Expendable point holder.

___ Carbide-tipped drill bit.

___ Well point.

___ Water trap.

___ Soil-gas sample collection vessel; 250-ml bulb with Teflon septum or three-liter evacuated stainless steel sampling canister.

___ Macro-Core or large bore sampler.

___ Macro-core sample liners.

___ Large bore sample liners.

___ Hose clamps.

___ Vacuum gauge.

___ Polyethylene and/or tygon tubing.

Various accessory tools are required for Geoprobe operation. These include pipe wrenches in a variety of sizes, standard and phillips screwdrivers, various hammers, such as rock hammers and sledges, pliers and vice grips, wire cutters and electrical and duct tape.

D. PROCEDURES

1. Soil Sampling With The Geoprobe

If collection of soil samples with the Geoprobe is anticipated, the geoprobe unit and a trained Geoprobe operator must be obtained in advance (Figure 15a). The utility companies must be contacted by the project manager through JULIE (DIGGER in Chicago) and a site meet scheduled before Geoprobe work begins. Soil samples can be collected two ways with the Geoprobe - Macro-Core Sampling and Large Bore Sampling.

a. Macro-Core Sampling

The Macro-Core device is used to make continuous cores to depths of up to 30 feet (Figure 15c). The Macro-Core is a 4 foot long stainless steel tube with an outer diameter of 2 inches and an inner diameter of 1.5 inches.

i. The samples are taken in four foot intervals with probe rods being attached to the sampler for depths beyond 4 feet.

ii. A plastic liner is inserted into the tube, a cutting shoe is screwed onto the lower end of the tube and a drive head (with drive cap) is screwed onto the upper part of the tube. The drive head is then placed under the Geoprobe anvil and the Macro-Core device is advanced into the ground in 4 foot intervals.

iii. When the Macro-Core is withdrawn from the hole the pull cap is put on to replace drive cap. The plastic sleeve containing the core is removed from the Macro-Core tube.

iv. There are plastic caps that can be put on the ends of the sleeve after coring to prevent volatile from escaping from the core. The sample can be collected from the sleeve and sent to the lab or, in some cases, the capped sleeve can be sent directly to the lab.

When coring in loose sediments plastic core catchers can be placed on the end of the Macro-Core to prevent parts of the core from falling out of the bottom of the tube when it is being raised out of the hole.

Care should be taken to prevent overpacking of the soil in the Macro-Core, since this is can result in the sleeve swelling in the Macro-Core tube and becoming stuck.

The Macro-Core can only be used in unconsolidated deposits and it is not recommended for use in deposits containing large rocks or debris.

In some cases it is possible to pre-probe through undesirable intervals with probe rods and a large diameter point to prevent damage to the Macro-Core.

b. Large Bore Sampling

The Large Bore Sampler can be used to take a 22 inch long, 1.06 inch diameter core at depths of up to 60 feet (Figure 15b). The Large Bore Sampler is primarily designed to be a discrete sampling device to take a sample at a prescribed depth. The Large Bore Sampler is a 22 inch long, 1.375 inch diameter tube.

i. A plastic liner is inserted into the tube, a drive head is screwed into the top part of the tube and a cutting shoe is screwed into the bottom part of the tube. The bottom part of the tube contains a piston tip which can be retracted when the sampling depth is reached. Rods are added to the device until the desired sampling depth is reached.

ii. The piston tip is retracted using Geoprobe extension rods which can be lowered into the hollow probe rods and attach to the piston tip.

iii. After the piston tip is retracted the Large Bore Sampler is advanced approximately 22 inches to take the core and then the Large Bore Sampler and rods are pulled from the hole.

iv. Once out of the hole the liner containing the core can be removed from the coring tube. The sample can be collected from the liner or in some cases capped and sent to the lab.

The Large Bore Sampler can only be used in unconsolidated deposits and it is not recommended for use in deposits which contain large rocks or debris.

c. Sample Handling

After the sample collection is complete, the Geoprobe operator will fill in the hole, decontaminate the Geoprobe equipment, and discard unusable equipment.

The handling of sample bottles and order of sample collection should be conducted as described in Section VI.

d. Other Functions

There are two other functions that the Geoprobe is capable of - soil gas sampling and breaking through solid materials.

i. Soil Gas Sampling

An expendable point is the inserted into this holder and the pipe unit is pushed into the ground. The pushing motion is accomplished in the same fashion as inserting the well point. The probe rod is then pulled up approximately one foot to release the expendable point. By pulling the probe up a void is formed from which the vapor sample is collected. After pulling up the probe rod the sample cap is attached again with Teflon® tape or an O-ring. The gas sampling collection system is then hooked up. The hydraulic vacuum pump on board the vehicle is used to create the vacuum. The probe pipe is then removed from the ground leaving the expendable point down the hole.

ii. Carbide-Tipped Drill Bit

This bit is for use on concrete, asphalt, or any other hard surface, such as frozen ground. Slowly push down on the probe lever to start the drill into the ground surface.

2. Groundwater Sampling With The Geoprobe

If collection of groundwater samples with the Geoprobe is anticipated, the Geoprobe unit and a trained operator must be scheduled in advance (Figure 15a). The utility companies must be contacted by the project manager through JULIE (DIGGER in Chicago) and a site meet scheduled before Geoprobe work begins.

Groundwater samples can be collected a number of different ways using the Geoprobe. Currently used methods of obtaining groundwater samples include pre-coring a hole using a macro-core device and/or some variation of a discrete groundwater sampling device.

a. Macro-Core Sampling

i. Macro-Core Sampling

One method which is often used when attempting to obtain a sample from the unconfined aquifer is to Macro-Core a two inch hole and pump or bail the groundwater sample out of the hole (Figure 15c). This method has the advantage of giving the observer an idea of the lithology of the aquifer. Hole conditions will dictate whether it will be necessary to use screened (or slotted) well pipe or drive rods with a drive point on the end, or if it is feasible to lower open end drill pipe or rods onto the hole (Figure 15d).

b. Discrete Sampling

If the water sample to be collected is from a confined aquifer only or if it is unfeasible to Macro-Core, then a discrete water sample can be collected. The discrete groundwater sampling devices are designed to be driven with a expendable point to a desired depth. The rods are raised a small amount (usually 2-4 feet depending on the type of device) and a screen is exposed. Water then enters the rods or well pipe via the screen and the groundwater sample can be pumped or bailed. Once the sample is collected then the rods and screen are removed leaving the expendable point in the bottom of the hole.

Once the hole is open the groundwater sample can be collected with the use of peristaltic pump, bailer (bailer diameter is dependent on the well pipe or inner rod diameter), or 1/4 inch standard tubing with foot valve. For holes that are pre-cored with a Macro-Core device, any of the above methods can be used to retrieve a groundwater sample. Due to the small inner diameter of the current Geoprobe rods, it is usually necessary to pump the sample out of the hole using a peristaltic pump when taking a discrete sample. However, Geoprobe does make a small foot valve (or check valve) that fits on the end of standard 1/4 inch ID tubing and an oscillating motion pumps a water column up into the tubing. A 20 inch long, 7/16 inch diameter mini-bailer can be used within the Geoprobe drive rods to obtain a 20 mL sample for volatile organics. The depth of the hole and the depth of the water should be noted.

c. Sample Collection

i. Peristaltic Pump Sample Collection

It is not necessary to purge the sample hole before sample collection because the sample is being collected directly from the aquifer. However, it is sometimes desirable to let the water clear of sediment somewhat before beginning sample collection.

If the sample is to be collected with a peristaltic pump, additional tubing is attached to the peristaltic pump and the tubing is lowered into the hole. The groundwater can be pumped directly into sample containers. Refer to Section VII above.

If the sample is to be filtered, the filter can be attached to the tubing, filling the sample containers with filtered water directly from the hole. Refer to Section VII above.

When using a peristaltic pump, care should be taken not use the pump in a situation which exceeds the recommended lift capacity for that pump (29 feet for pumps currently used by IEPA). If the water level is deeper than the pump's lift capacity, then a different method such as some form of bailing must be used. A common problem associated with pumping water from well pipe which is slotted or contains a screen, is clogging of the slots or screen by silts and clays. When this occurs then the slotted pipe or screen must be brought to the surface and cleaned.

The tubing for the peristaltic pump should be discarded after each use to prevent cross-contamination.

ii. Bailer Sample Collection

It is not necessary to purge the sample hole before sample collection because the sample is being collected directly from the aquifer. However, it is sometimes desirable to let the water clear of sediment somewhat before beginning sample collection.

If a bailer is used to collect the sample, the bailer diameter will be dependent on the well pipe or inner rod diameter. Again, the sample containers can be filled directly from the bailer. Refer to Section VII above.

If the sample is to be filtered, the groundwater should be bailed from the hole and placed in a clean pre-filtration bottle. Then the sample can be filtered into the sample container. Refer to Section VII above.

d. Sample Handling

The handling of sample bottles and order of sample collection should be conducted as described in Section VII.

After the sample collection is complete, the Geoprobe operator will fill in the hole, decontaminate the Geoprobe equipment, and discard unusable equipment.

D. REFERENCES

Geoprobe Systems, A Division of Kejr Engineering, Inc. Geoprobe Systems, Model 8-A Operations Manual., 1995., Salina, KS.

U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations., 12/1987., EPA/540/p-87/001.

E. FIGURES

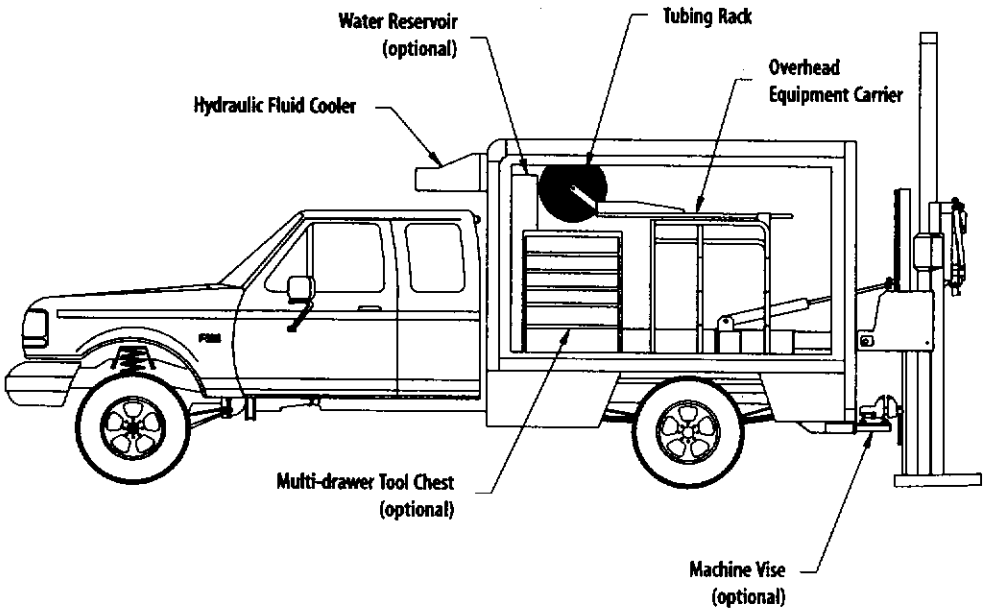
15a -- Geoprobe in Boring Position

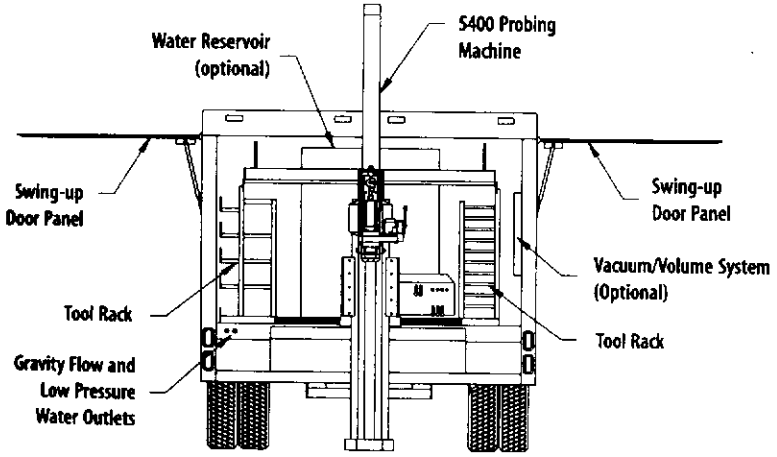
15b -- Macro-Core Soil Sampler

15c -- Large Bore Soil Sampler

15d -- Screen Point Sampler

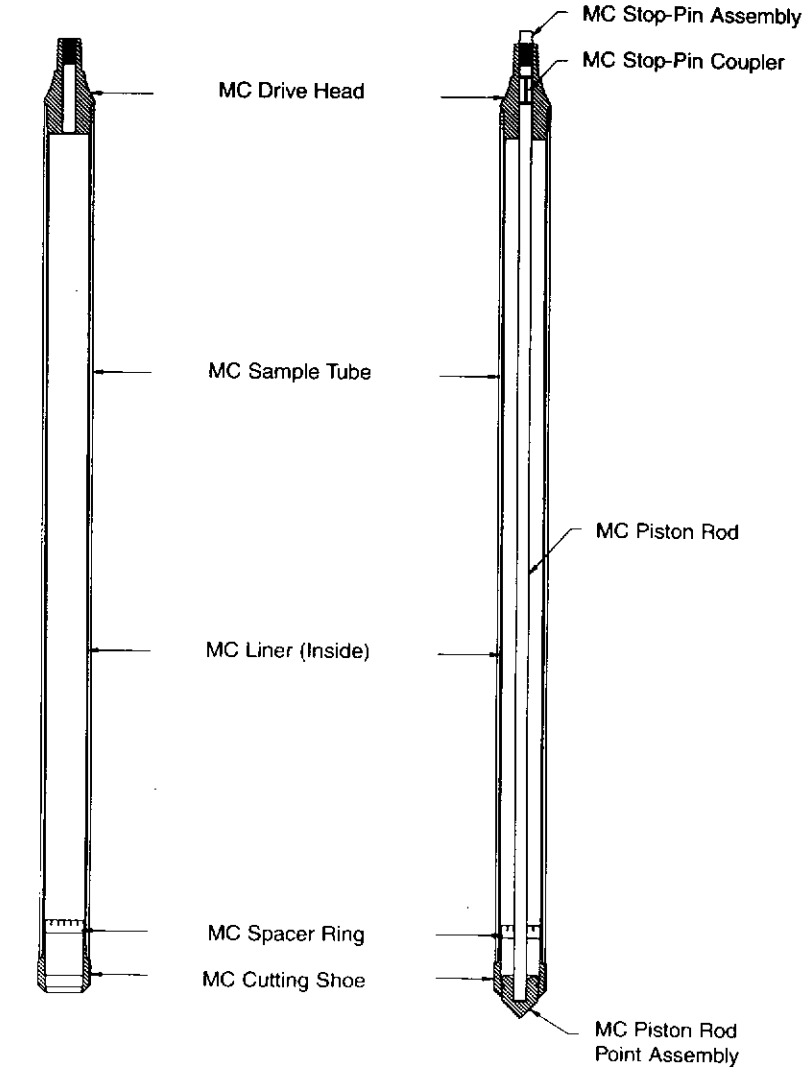
FIGURE 15a -- GEOPROBE IN BORING POSITION





September 1996 (diagram revised 7/2003)

FIGURE 15b -- MACRO-CORE SOIL SAMPLER

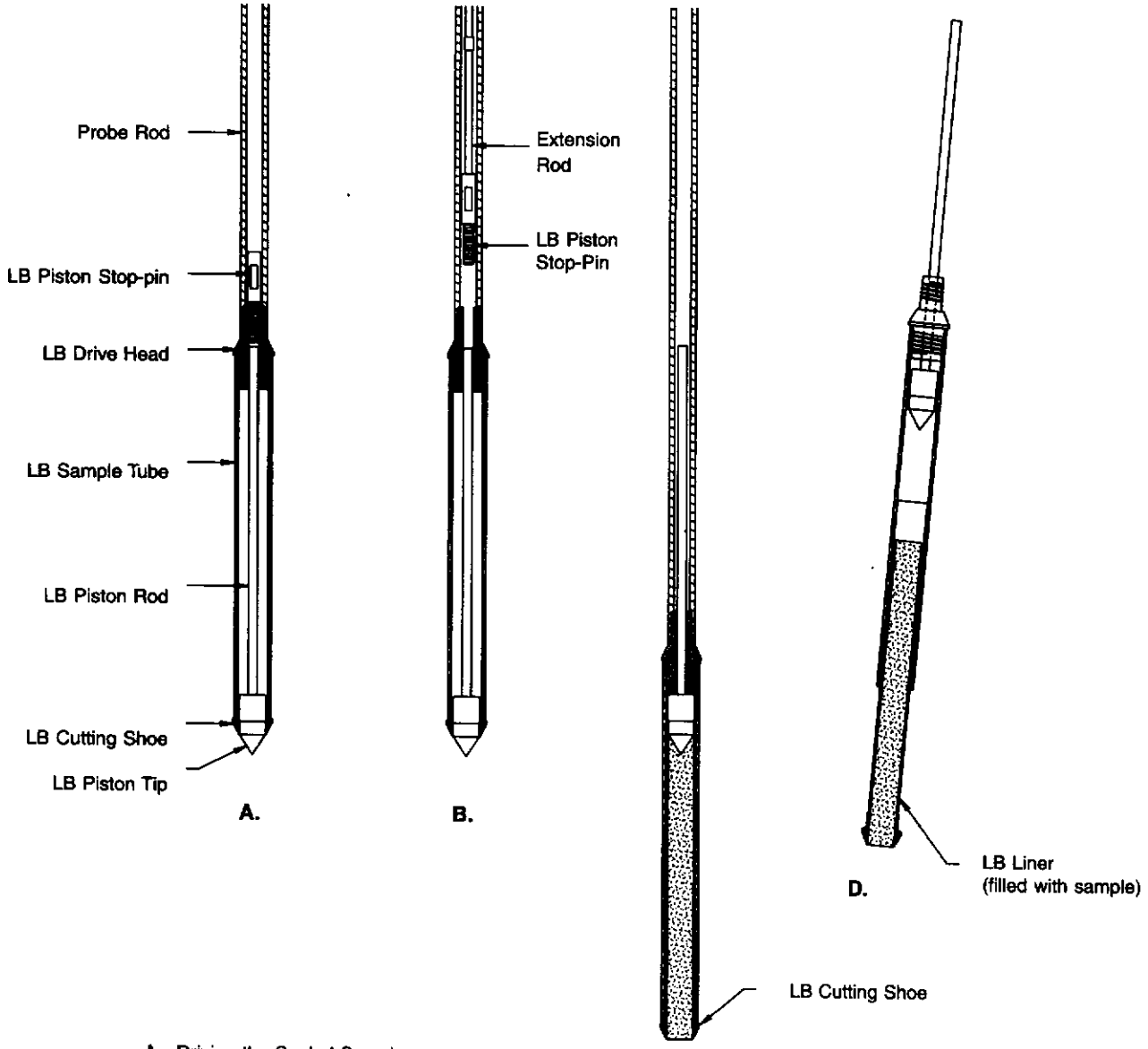


A. Open-Tube System

B. Closed-Point System

September 1996 (diagram revised 7/2003)

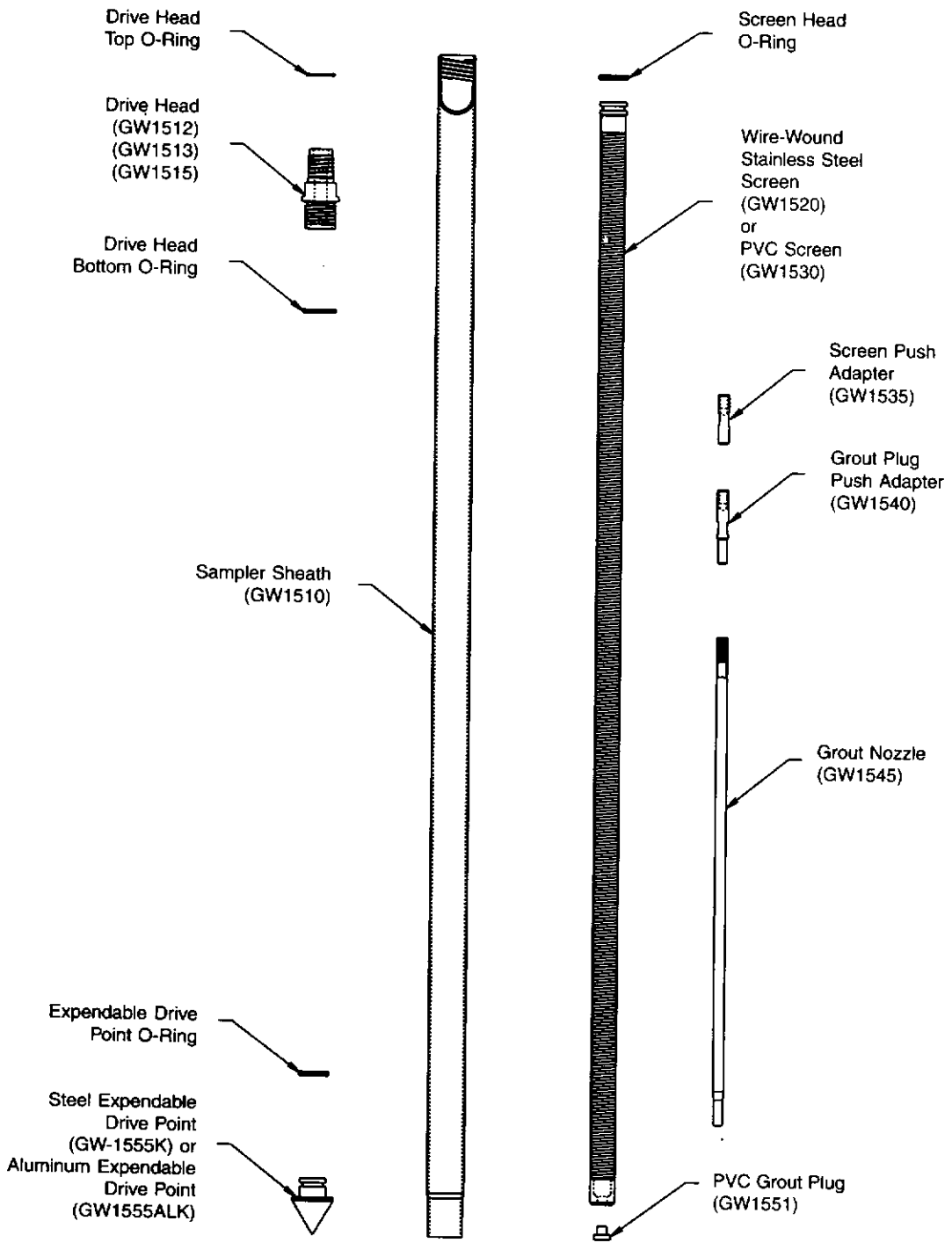
FIGURE 15c -- LARGE BORE SOIL SAMPLER



A. Driving the Sealed Sampler
B. Removing the Stop-Pin
C. Collecting a Sample
D. Recovering Sample in Liner

September 1996 (diagram revised 7/2003)

FIGURE 15d – SCREEN POINT SAMPLER



September 1996 (diagram revised 7/2003)

SECTION XVI: WAREHOUSE PROCEDURES

For pick-up and drop-off of equipment/commodities at the warehouse please use the following procedures.

Contact warehouse personnel at least 24 hours prior to a sampling event to ensure sampling equipment will be available.

E-mail equipment and commodity needs ahead of time. Warehouse personnel can have your request ready for pickup upon arrival.

Equipment check out procedures at the Warehouse

Sampling personnel are to check equipment before leaving to ensure monitoring equipment is functioning properly, and sampling equipment is clean and ready for use.

A warehouse distribution report must be filled out and signed by sampling personnel before leaving.

Buckets, scrub brushes and sanitizing soap are available for checkout prior to leaving for sampling event.

Equipment check in procedures for the Warehouse

Upon returning to the warehouse all contaminated disposable article must be sealed in trash bags and disposed of in the dumpster out side the warehouse. Contaminated articles are not to be brought back into the warehouse.

All sampling equipment must be free of any residue from sampling at the time they are returned to the warehouse.

A high pressure washer is available at the warehouse to clean equipment before it enters the warehouse. The pressure washer is capable of providing 1,700 pounds of pressure and 250 degrees of heat.

All monitoring equipment should be clean and free of sampling residue.

It is the responsibility of the sampling personnel to check back in all unused commodity items. All unused commodities should be put back in their proper places.

When checking in monitoring equipment warehouse personnel will check to make sure equipments is still in good working order.